AMERICAN GAS ASSOCIATION MONTHLY

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SEPTEMBER, 1922

No man ever got nervous prostration pushing his business; you get it only when the business pushes you.

Elbert Hubbard.

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FOR STATEMENTS AND OPINIONS CONTAINED IN PAPERS AND DISCUSSIONS APPEARING HEREIN, THE ASSOCIATION DOES NOT HOLD ITSELF RESPONSIBLE

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A Very Live Corpse

A short while ago one of the market agencies or stock market prophets, in their confidential report to their clients, made the statement, that—"Gas Companies have probably seen their best days. Certainly when a cheap method of heating by electricity is discovered, gas companies for the most part, will go out of existence."

Of course this was an unfortunate statement to make—unfortunate since it was undoubtedly made without sufficient consultation of the facts, for we cannot see how it could have been made if the following figures on sales of gas had been consulted.

1901	101,625,366,000	Cubic Feet
1902	92,714,667,000	"
1903	105,676,479,000	"
1904	113,930,140,000	"
1905	112,444,237,000	"
1906	122,849,725,000	"
1907	132,011,582,000	"
1908	138,570,073,000	"
1909	143,117,693,000	"
1910	149,430,549,000	"
1911	159,160,874,000	"
1912	178,228,754,000	"
1913	188,285,840,000	"
1914	198,838,834,000	"
1915	204,309,522,000	"
1916	231,381,313,000	"
1917	264,493,003,000	"
1918	271,593,141,000	"
1919	306,632,786,000	"
1920	319,887,813,000	"

Any mistake of such a grievous character is, of course, regrettable, since no matter how innocently the mistake was made, it would undoubtedly tend to prejudice those who read it.

But, like the proverbial ill wind, it has its bright side, also.

Almost simultaneously with its publication, Association headquarters began to be deluged with protests. These came, not only from within the gas industry, but from outside sources—many from financial houses, a fairly certain indication that the corpse was a distinctly live one.

Furthermore, coincident with the Association's protest to this statement, articles began to appear in such publications as financial journals and newspapers, national financial magazines, investment publications of banks, bulletins published by houses dealing in securities, advertising publications, bulletins issued by State Committees on public utility information and in the financial columns of the press all over the country.

And these articles all clearly refuted the implication quoted above.

Again, as though to back up these articles, investment houses inaugurated the sale of utility securities with a fresh impetus.

The answer is very plain. Only a very live corpse would or could have made such a response to such a regrettable error.

AMERICAN
GAS ASSOCIATION
MONTHLY

Vol. IV SEPTEMBER, 1922 No. 9

Report I of the Commission* on Resuscitation from Carbon Monoxide Asphyxia to The American Gas Association

The Treatment of Carbon Monoxide Asphyxia by Means of Oxygen + CO_2 Inhalation—A Method for the Rapid Elimination of Carbon Monoxide From the Blood.

YANDELL HENDERSON, PH.D. and HOWARD W. HAGGARD, M. D.
With the Collaboration of Stuart Scott, M. D.

This report, a most important part of the work of the Accident Prevention Committee, is printed in advance of its presentation to the Convention because of its very importance. The material contained therein is of such immense value to the gas industry and to the entire world that any delay in presenting it might well be considered unpardonable. (EDITOR'S NOTE.)

AT a meeting of the Commission on Resuscitation from carbon monoxide asphyxia on November 15, 1921, the writers were appointed a sub-committee to conduct investigations both in the field and in the laboratory on the treatment of carbon monoxide asphyxia by the inhalation method, to be here described.

There is already available a considerable mass of theoretical knowledge and experimental material upon which to base further advance along the line indicated. Recent investigations in this laboratory (1) have confirmed the correctness of the view that carbon monoxide has no direct toxic action on the brain, or other organs or tissues of the body except only the blood. It acts wholly through its combiination with the hemoglobin or red coloring matter of the blood. When so combined, the hemoglobin is for the time deprived of the power to transport oxygen from the lungs to the tissues of the body. A con-

*The Commission on Resuscitation from Carbon Monoxide Asphyxia was organized at the request of the American Gas Association. The Commission consists of Cecil K. Drinker, M. D., Chairman; Walter B. Cannon, M. D.; David L. Edsall, M. D.; Howard W. Haggard, M. D.; Lawrence J. Henderson, M. D.; Yandell Henderson, Ph. D.; Warren K. Lewis, Ph. D.; Francis W. Peabody, M. D.; Royd R. Sayers, M. D.; for U. S. Bureau of Mines; Charles B. Scott, for American Gas Association.

dition of asphyxia, or oxygen deprivation therefore develops.

These investigations have also confirmed the findings of previous investigators, particularly Haldane, (2) that the combination of carbon monoxide with hemoglobin is reversible; that is, that by the mass action of oxygen the carbon monoxide which has been absorbed may be again completely displaced. The oxygen transporting power of the blood may be thus completely restored.

The principal treatments heretofore proposed for carbon monoxide poisoning are bleeeding, transfusion, artificial respiration, and oxygen inhalation. There is no adequate theoretical reason for bleeding in this condition, but rather the contrary, for it is probably injurious by further depleting the oxygen transporting power of the blood. Transfusion of normal blood is probably quite ineffective; for in order to be beneficial, it would need to be performed within one, or at most two, hours after termination of the gassing; and this is in most cases quite impracticable.

Artificial respiration, preferably by the manual prone pressure or Schafer method sometimes plays a crucial part in resuscitation from carbon monoxide asphyxia, but on the whole is less important in this condition than in resuscitation from drowning or from electric shock. In carbon monoxide asphyxia as in the other two conditions, artificial respiration may indeed at times be essential to start spontaneous breathing. The victim of drowning or electric shock has virtually been saved when restoration of respiration has been accomplished. The resuscitation of a man or animal asphyxiated by carbon monoxide is not so simple. Natural breathing may be restored, indeed the victim may not have stopped breathing at all while in the gassing chamber; and yet he may die hours or days later from the effects of the asphyxia.

Slight Effectiveness of Oxygen Alone

Oxygen inhalation offers therefore the one promising line of attack on this problem. Theoretically it is the obvious method for displacing carbon monoxide from the blood and thus restoring to hemoglobin its normal capacity to carry oxygen to the brain and other organs so as to overcome asphyxia. In practice, however, oxygen inhalation has not fulfilled its theoretical promise. It needs some auxiliary agent.

This ineffectiveness of oxygen alone seems to have been due to several contributing causes of which three may be mentioned:

There has been no efficient apparatus generally available for administering oxygen inhalation. When oxygen is given through a glass funnel suspended a few inches above the patient's face, very little—or none, if there is a draft in the room—reaches the patient. A well fitting mask is essential for unconscious subjects. The flow of gas should also be adjusted to the respiratory needs of the patient. Only in the so-called "self-contained oxygen apparatus," (3) used for mine rescue work and employed to some extent also by city firemen and the emergency crews of gas companies, is there an apparatus at all suitable to this purpose; but such apparatus needs to be changed from a closed to an open circuit so as to avoid re-breathing, in order to suit it to the treatment of carbon monoxide asphyxiation.

The application of treatment by oxygen inhalation, or indeed of any treatment in

cases of gas asphyxiation, is generally too long delayed to be at all effective. Asphyxia is not immediately terminated when the victim is removed from the gassing chamber, or when the gas is turned off and the windows opened. The carbon monoxide comes off from his blood so slowly during the first two or three hours that, although his body may be surrounded and his lungs filled with fresh air, his brain continues to be asphyxiated. On the other hand the greater part of the carbon monoxide comes off in the course of four or five hours and it then does very little good to administer oxygen; for when the brain has been too long asphyxiated it probably becomes oedematous and degenerative processes set in. It is this condition of post-asphyxial coma, after the primary stage of asphyxia is past and much of the carbon monoxide has come off, which is usually seen in the hospitals. It does no good to transfuse blood from a healthy person into such a person six or eight hours after the gassing, for by that time his own blood has to a large extent spontaneously thrown off the carbon monoxide and regained oxygen. The continued coma is probably due, not to asphyxia at that time but to the brain oedema and the degenerative processes just referred to.

The point can not be too strongly emphasized that for treatment to be effective it must be applied at the earliest possible moment after the victim is discovered and must remove the carbon monoxide from his blood as soon as possible.

The third reason why oxygen inhalation is not very effective even when an efficient inhaler is used depends upon a more fundamental physiological consideration. It is true that in partial asphyxiations, both as they occur accidentally and as performed experimentally by investigators upon themselves, oxygen inhalation effects a considerable alleviation of the headache and other immediate sequelae. It induces also a somewhat, but initially a not very greatly, accelerated elimination of carbon monoxide from the blood. This is essentially the finding of Haldane (2) and his collaborators, in England, of Nicloux (4) in France, and of the authors in experiments upon themselves to be here reported. The authors have been privileged to see also, in manuscript, the results of experiments, closely similar to those here reported, obtained by Dr. R. R. Sayers and W. P. Yant at the Bureau of Mines Experiment Station, Pittsburgh, Pa.

It is probable, however, that such observations have led to a much too favorable expectation of the benefits of simple oxygen inhalation in cases which have been asphyxiated into coma. In experiments upon themselves, investigators have, indeed, induced percentage saturations of the blood with carbon monoxide approximating dangerous concentration. They have not, however, continued the asphyxiation until coma resulted. The ability of their circulation and respiration to effect the subsequent elimination of the asphyxiant unaided has not therefore been greatly depressed; and under such conditions oxygen assists considerably. But when the depression of vitality has gone to the extent in the victim of an accidental asphyxiation, which occurs with many hours of coma, oxygen alone is comparatively ineffective. The distinction as regards the rate of elimination of carbon monoxide after brief gassing and after profound asphyxia is much like that occurring in the rate at which patients eliminate ether after short, in contrast to long, anaesthesias.

With carbon monoxide, as with ether, there is a difference between the extent to which respiration is depressed after slight, in contrast to profound, anaesthesia or asphyxia. In both of the latter conditions, respiration is sometimes so feeble that it fails and death occurs even after oxygen inhalation has been applied, for oxygen is not a respiratory stimulant.

The depression of respiration occurring during and after asphyxia, and impelling toward a fatal issue, is probably the resultant of several different, although related factors and processes: initial overbreathing, disturbance of the alkali and C_H of the blood, fatigue of the respiratory center, the direct action of oxygen deficiency, and circulatory and oedematous conditions. It is not possible —nor necessary for the present purpose —to evaluate their relative importance. Probably all play parts in all cases, but of varying relative intensity. The following paragraphs are intended merely to indicate their nature, and to suggest their modes of interaction.

The breathing of a normal man or animal, as is now well known, is largely regulated by the carbonic acid or CO_2 produced in the muscles and organs and carried by the blood to the respiratory center in the brain. Carbonic acid is the normal stimulus to this center and thus regulates normal breathing. During asphyxia, however, the oxygen deficiency in the blood exerts an abnormal and excessive action on this center and induces excessive breathing by which the body's store of CO_2 is greatly reduced. In previous work from this laboratory (5) it has been shown that during asphyxia as the saturation of the blood with carbon monoxide increases, the oxygen deficiency induces a progressively increasing volume of breathing. In a dog in an atmosphere of 0.17 per cent of carbon monoxide the volume of air breathed per minute was found to increase from the normal expressed as 100, up to 164 per cent in two hours, and 266 per cent in three hours. From this high level it decreased progressively in the course of little more than an hour until death from respiratory failure occurred. In another experiment the increase of pulmonary ventilation was up to 200 in three hours and 350 per cent in six hours; in another to 200 per cent in four hours. During recovery in fresh air the volume of breathing is often correspondingly depressed. In some cases it is scarcely measureable and only gradually returns. In one case, 20 minutes after removal from the gassing chamber the animal attained a volume of breathing only 66 per cent of the normal. In another case, respiration was too feeble to move the valves of the mask connected with the measuring apparatus.

This excessively large volume of breathing maintained sometimes for many hours, predisposes to subsequent subnormal breathing or even to respiratory failure of the apnoea vera type. It has also other profound physiological effects. Thus in the experiments cited, the CO_2 content of the blood, which is now accepted as a measure of the blood alkali in use, fell to 26 volumes per cent, or 63 per cent of the initial value; in another experiment the blood alkali was reduced to 76 per cent of the normal; and in the fatal case above-mentioned, it was found shortly before death to be only 37 per cent of the initial normal value. This condition of extreme acapnia was for a time erroneously regarded as an acidosis, whereas it is rather an alkalosis and involves corresponding disturbances in the equilibrium of the blood and tissues. (6)

Among these disturbances of various equilibria, one which may perhaps play an important part has to do with the avidity with which hemoglobin retains both carbon monoxide and such oxygen as it still holds, thus further starving the tissues. The work of Bohr, (7) Haldane, (2) and Barcroft (8) has shown that variations in the CO_2 content of the blood acting through its C_H exert a marked influence upon the dissociation of oxygen from hemoglobin. Acapnia and alkalosis induce the condition termed by Barcroft pleionexy, in which the avidity of hemoglobin for oxygen, and according to Haldane for carbon monoxide also, is greatly intensified.

Along with these conditions there is probably also a fatigue of the respiratory center both from the excessive stimulation to which it has been subjected during the period of respiratory excitement and from the anoxemia, the latter acting much like a profound anaesthesia. As recent investigations of Haldane (Respiration p. 55) have emphasized "even a slight deficiency in the oxygenization of the arterial blood greatly favors the development of fatigue symptons in the respiratory center."

In consequence of these, and perhaps of other as yet incompletely analyzed effects, when a victim of profound asphyxia is given an oxygen inhalation he breathes so poorly, draws so little of the oxygen into his lungs, and in consequence displaces so little of the carbon monoxide from his blood, that the benefits of the treatment are often for a time scarcely perceptible. Indeed in experiments carried out for the special purpose of testing this point, some of the animals stopped breathing and died after oxygen inhalation was begun. This occurrence may perhaps be in part a form of the "oxygen apnoea" first noted by Mosso (9), and easily obtained with oxygen after exertion at great altitudes. (10).

After prolonged and profound asphyxia some accessory factor is needed to stimulate the patient to vigorous breathing so that he may draw the oxygen in and thus wash the carbon monoxide out. The most natural means of obtaining this end is to supply enough CO_2 mixed with the oxygen to serve as an immediate stimulus to breathing. Much the same idea has been utilized by the writers to induce vigorous breathing, rapid elimination of ether, and a rapid restoration of consciousness in patients after prolonged anaesthesia. (11). The addition of CO_2 to the inhaled air proved highly effective in stimulating action of pulmonary ventilation, and washing out ether from the blood.

Experiments upon Animals

Following this line of thought experiments were performed upon dogs and the results obtained are shown in the four curves of Figure 1. By means of illuminating gas diluted with air the animals were all asphyxiated to as nearly

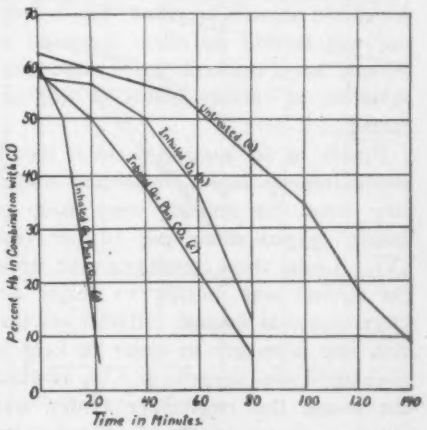

Fig. 1

as possible the same degree namely almost to the point of death. Samples of blood were drawn at intervals thereafter and analyzed for carbon monoxide so as to show the rate of elimination. Each curve is the composite of two or more such experiments detailed in the initial publication. (12).

After removal from the gassing chamber the animals of the first group were left to recover spontaneously. As shown in the upper curve, the rate of elimination during the first hour was very slow indeed, depending upon the fact that the animals were scarcely breathing.

In the second curve is shown the rate of elimination in animals under oxygen inhalation. The volume of breathing was no greater, indeed perhaps rather less, than in the previous group, and the rate of elimination was initially only slightly more rapid. With oxygen, as with air, the rate of elimination of carbon monoxide becomes considerable only as the depression of respiration wears off, and efficient pulmonary ventilation returns.

In a third curve is shown the effect of adding a small amount of CO_2 to the air which the animals breathed. The breathing was thereby so much increased in volume that a markedly more rapid elimmination of carbon monoxide was obtained.

Finally in the steepest curve is shown the extremely rapid elimination occurring when the animals were made to inhale oxygen containing 10 per cent CO_2. Under these conditions even when the subject was initially so deeply asphyxiated that manual artificial respiration was necessary in order to keep it alive until the oxygen + CO_2 reached the lungs, the respiratory center was within a minute or two stimulated to renewed and increased activity. The breathing returned to normal and then to nearly or quite the maximum pulmonary ventilation of which the animal was capable. The lungs were thus ventilated with a corresponding volume of oxygen, and under the mass action of this constantly renewed oxygen, an approximately complete elimination of carbon monoxide from the blood was obtained in the course of 20 to 25 minutes. From a state of complete unconsciousness the animals returned to full vital activity although frequently in a dangerously bad temper.

The only risk which it was found necessary to avoid was an action on the heart due to the use in some of the earlier experiments of excessively high percentages of CO_2; but this risk was obviated by administering a moderate dose of atropin or reducing to some extent the amount of CO_2 employed.

Experiments upon Men

In order to determine how far similar results are obtainable upon men, the following experiments were performed by the writers upon themselves and some of their associates in this investigation. The gassing and treatment were varied from the animal experiments merely by using carbon monoxide prepared from formic acid instead of illuminating gas. Higher concentrations of carbon monoxide were used in these experiments on men than in those on animals, but the periods of exposure were shorter. In the therapeutic inhalation after the gassing the amount of CO_2 added to the oxygen was reduced to 5 per cent for this amount proved quite adequate to stimulate respiration and is free from the discomfort of higher percentages. Furthermore, observations upon men carried out under the direction of Dr. E. R. Sayers

at the Bureau of Mines Experiment Station, and mentioned here by his permission, had showed that 10, or even 8, per cent CO_2 is much too high a concentration, for the best results on men, involving headache, labored breathing, and other disadvantages. In the following experiments a mixture of oxygen and 5 per cent CO_2 was therefore used, and no discomfort of this sort was experienced.

The method employed was for the subject to spend 30 to 40 minutes in a gassing chamber of 6 cubic meters capacity, the air of which contained about 0.2 per cent of carbon monoxide. At the end of this time the blood analyses showed 35 to 50 per cent of saturation. This is enough gas, as previous work here shows, to render an untreated subject severely ill within an hour or two with headache, nausea, vomiting and vertigo. A few hours in such an atmosphere would kill.

Immediately after the subject came out of the gassing chamber, he lay down and the therapeutic inhalation was administered to him for 25 to 30 minutes. Two experiments were done on each of four subjects. With two of these subjects after the first gassing, oxygen and 5 per cent CO_2 were inhaled, while after the second gassing, the next day, an inhalation of oxygen alone was given; on the other two subjects the reverse order was used, without affecting the relative effects of oxygen + CO_2 as compared with oxygen alone. In two of the subjects the rate of elimination with no treatment had been determined in previous work. (13) In a fifth subject only the first experiment, i.e., gassing and treatment with oxygen + CO_2, was performed. In all the experiments samples of blood were taken and analyzed by the tannic acid method (see below) as follows: (a) before gassing, (b) immediately after gassing, (c) after 15 minutes of inhalation of oxygen + CO_2 or of oxygen alone, (d) at the end of the inhalation, and (e) half an hour later. The protocols of these experiments follow together with graphs plotted from the results on two of these subjects.

In these protocols and diagrams it is to be seen that when breathing oxygen the rate of elimination of carbon monoxide is somewhat more rapid than when the subject breathes merely air, but that the elimination is enormously accelerated when the inhalation consists of oxygen + CO_2. In the latter case the breathing is augmented 300 to 500 per cent and the removal of carbon monoxide is accelerated proportionally. Thus a blood concentration of carbon monoxide of 40 to 50 per cent saturation, a dangerous amount, was reduced to only 10 or 12 per cent, a quite harmless amount, in half an hour.

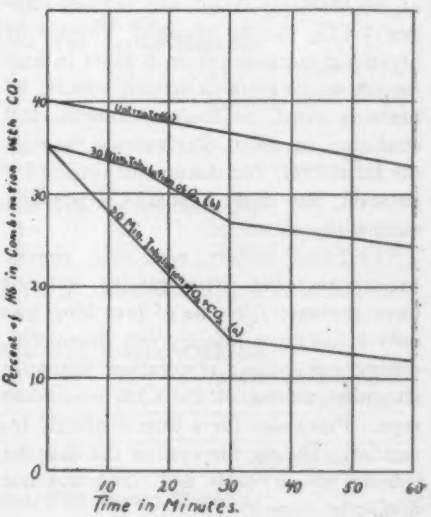

Fig. 2

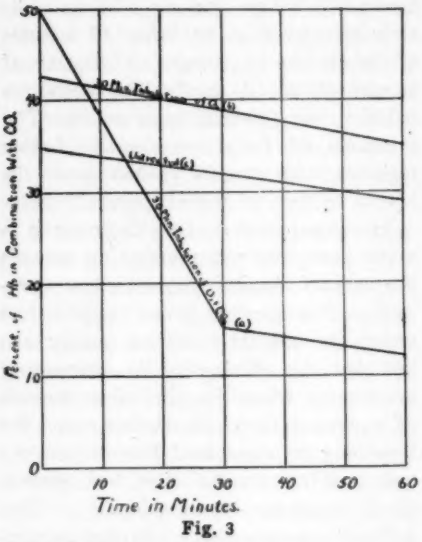

Fig. 3

Protocols

Y. H., male, 49 years, 170 pounds.

(a) Gassed in 0.2 per cent carbon monoxide for 30 minutes; standing and moving during gassing. Then came out of chamber, lay down, and inhaled oxygen + CO_2 for 25 minutes. Volume of breathing increased from 9 liters in first minute to 15 liters in second minute, 20 liters in third, 30 liters in fourth, and continued at about this volume through the inhalation. No discomfort during inhalation, but slight headache afterward, otherwise well.

(b) Same subject, next day, similar experiment; but after gassing, inhaled oxygen alone. Volume of breathing was only 5 liters per minute, i.e., subnormal, during inhalation; respiration distinctly irregular, almost of the Cheynes-Stokes type. Pulse also for a time distinctly irregular. During the rest of the day the subject was irritable and tired, but not distinctly unwell.

(c) Same subject (two years ago) after similar experiment but not followed by inhalation of oxygen, was distinctly unwell with throbbing frontal headache for 12 hours.

The rates of elimination of carbon monoxide in these three experiments are shown by the following analyses of the blood for percentage of saturation. Table 1.

H. W. H., male, 30 years, 200 pounds.

(a) Gassed and treated, like subject in previous experiment (a) and with similar effects. Volume of breathing under inhalation of oxygen + CO_2 increased from 9 up to 30 liters or more. Felt no after effects whatever.

(b) Gassed and treated, like subject in previous experiment (b). Under oxygen alone respiration was at first subnormal, then about normal, 10 liters per minute. Headache developed with increasing intensity all day, with dysponea on exertion; rather miserable.

(c) After similar but less intense gassing, two years ago, not followed by inhalation of oxygen, the subject developed a frontal headache and malaise lasting all day and followed by insomnia. The analyses for carbon monoxide in the blood showed: Table 2.

S. S., male, 28 years, 130 pounds.

(a) Gassed and treated, like previous subjects. (a) Under oxygen + CO_2 inhalation, the volume of breathing increased to 30 liters per minute. Felt no after effects, entirely normal.

(b) Gassed and treated like subjects (b). Volume of breathing under oxygen inhalation was only a little over 5 liters per minute. Felt miserable during remainder of day. Table 3.

M. M. J., female, 30 years, 160 pounds.

Conditions and results practically identical with those of previous experiment. Blood samples showed: Table 4.

R. R. S., male.

Gassed and treated like previous subjects. Respiration responded less vigorously than is usual in most persons to the stimulant of CO_2 in the inhalation. Felt slightly unwell afterward. Blood samples showed: Table 5.

Investigation in New York City

With the foregoing facts as a background a carefully planned and supervised test of this method of oxygen + CO_2 inhalation for human victims of carbon monoxide asphyxia seemed justifiable.

For some years past, work had been under way in this laboratory on an improved inhaler. During the war one of the authors had developed certain features of such an apparatus for administering oxygen (without CO_2) to soldiers suffering from the irritant war gasses. A number of these apparatus had been made and shipped to France but arrived only as fighting ceased. In the laboratory, meanwhile, a device had been developed for the control and measurement of the flow of gas. Meanwhile also, the sylphon bellows reducing valve, the most perfect device of its kind, had been developed by Mr. W. E. Gibbs for the U. S. Bureau of Mines and patented by the government for general use. Using these three features, the apparatus shown in Figure 4 was developed under the direction of the writers by the Mine Safety

Table 1

Expt.	Before Gassing	After Gassing 2 min.	15 min.	30 min.	60 min.	Treatment
	Percentage of Saturation of Blood With Carbon Monoxide					
(a)	0	35	25	15	12	Inhaled oxygen + CO_2
(b)	0	35	32	27	25	Inhaled oxygen alone
(c)	0	38	—	—	33	Breathed air

Table 2

Expt.	Before Gassing	After Gassing 2 min.	15 min.	30 min.	60 min.	Treatment
	Percentage of Saturation of Blood With Carbon Monoxide					
(a)	0	50	30	15	12	Inhaled oxygen + CO_2
(b)	0	45	42	40	35	Inhaled oxygen alone
(c)	0	34	—	—	29	Breathed air

Table 3

Expt.	Before Gassing	After Gassing 2 min.	15 min.	30 min.	60 min.	Treatment
	Percentage of Saturation of Blood With Carbon Monoxide					
(a)	0	45	25	15	12	Inhaled oxygen + CO_2
(b)	0	45	40	35	30	Inhaled oxygen alone

Table 4

Expt.	Before Gassing	After Gassing 2 min.	15 min.	30 min.	60 min.	Treatment
	Percentage of Saturation of Blood With Carbon Monoxide					
(a)	0	45	25	15	10	Inhaled oxygen + CO_2
(b)	0	40	35	30	28	Inhaled oxygen alone

Table 5

Before Gassing	After Gassing 15 min.	Under Inhalation 30 min.	60 min.	Treatment
	Percentage of Saturation of Blood With Carbon Monoxide			
0	35	20	10 (?)	8	oxygen + CO_2 inhalation

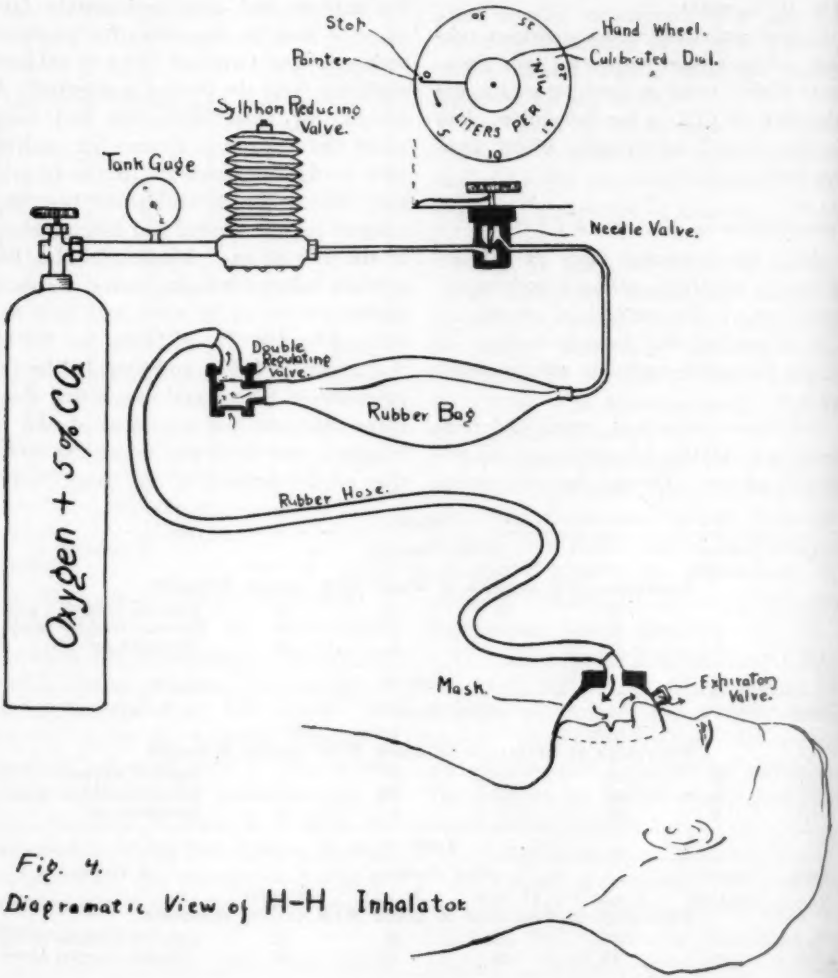

Fig. 4.
Diagramatic View of H-H Inhalator

Fig. 4

Appliances Co. The writers are indebted to this company for assuming all the risks and expense of development and for freely supplying the six inhalers used in the investigations to be described below.

The apparatus consists of a steel tank or bottle charged to about 120 atmospheres of oxygen and 6 atmospheres of CO_2—that is 5 per cent with an allowable variation of ± 0.5 per cent CO_2. The bottle is connected with the reducing valve which automatically delivers any quantity of gas that may be drawn at a

uniform pressure of about 1.5 pounds per square inch. The gas then passes through the graduated needle valve which serves both as a control and as a meter for estimating the volume of breathing, so that the supply to the patient can be adjusted to any volume from 0 up to 30 liters per minute. From this needle valve the gas flows into a bag of rubber and cloth of 4 or 5 liters capacity. Beyond this bag is a pair of disk valves arranged on a T so that the upper one, which has a very light disk, allows the patient to inhale the contents of the bag at the beginning of a respiration, while the lower valve with a heavier disk only opens to admit outside air after the bag has been sucked empty. From the upper disk valve a hose of 0.8 inch bore leads to a snout mask. Upon the mask is an expiratory valve. This apparatus has been given the name of the H.-H. Inhalator.

The following sheet of instructions was put into each of the inhalator boxes:

DIRECTIONS IN BRIEF:

I. Open valve at top of tank.

II. Put mask on victim.

III. Turn pointer on dial to 10.

IV. Keep advancing pointer as victim breathes more.

V. Use for 20 to 30 minutes.

DETAILED DIRECTIONS

1. This apparatus is charged with oxygen and another gas (CO_2) which makes the victim breathe many times the amount he otherwise would. It makes him pump the illuminating gas out of himself.

2. If the victim has stopped breathing before you arrive, apply both manual artificial respiration and the H.-H. Inhalator. If anything will start him breathing this inhalation will.

3. In using the inhalator, open the valve at the top of the black gas bottle. See that the pointer on the nickel plated dial is turned as nearly as possible to 0.

4. Put the mask over the victim's face. The lower part goes well below the chin. Press down firmly over the nose. Prevent leaks.

5. When the pointer on the nickel plated dial is at 0 the victim breathes air which he draws in through the inlet valve at the end of the long rubber hose.

6. As soon as the mask is on the victim's face, turn the pointer to 10. This lets gas run from the tank into the rubber bag. The victim breathes this. If he breathes more than runs in, the bag collapses and he draws in additional fresh air through the inlet valve.

7. As the victim's breathing increases, turn the pointer on the dial so as to just keep the bag from collapsing each time he breathes in.

8. If the victim goes well, the breathing will increase to 25 or 30 liters per minute—as shown on the dial—during the first 5 minutes.

9. Keep the pointer at about 25.

10. Usually 20 minutes of use of the inhalator is all that is necessary, but it may be given to severe cases for 40 minutes. More than this merely wastes the oxygen + CO_2.

Among the most serious practical difficulties to be anticipated was that of obtaining a supply of oxygen containing 5 per cent CO_2. No such gas mixture is at present on the market. This investigation is therefore deeply indebted to the Union Carbide and Carbon Company and the Linde Air Products Company for most generously making and freely supplying all of the oxygen + CO_2 used in these investigations.

It was next essential to have a field in which not only a considerable number of

asphyxiations were certain to occur in the period of intensive investigation of two months which was planned, but in which there must also exist facilities for reaching the cases at the earliest possible moment, that is within an hour, or better within 30 minutes after discovery. Previous experience had proved that in most cities even during the winter months when asphyxiations are most frequent, no considerable number of cases are reached soon enough to give the treatment a fair trial. Owing to delays in notification and the lack of the necessary arrangements, gas cases in most cities are not usually reached for from 2 to 3 hours or more after discovery.

The City of New York, Borough of Manhattan, however, affords ideal conditions for applying the treatment here under investigation. The Consolidated Gas Company maintains in each of five districts of the city, which owing to the congestion of population are comparatively small in area, an emergency auto truck. Each truck has three crews, each on duty for eight hours.

Furthermore, whenever these trucks are away from their stations, and during the day they are almost continually on the move, they keep constantly in touch by telephone with the central office. Twenty-four hours a day every day in the year, a dispatcher in the office of the gas company is ready at the telephone to receive from the police, from hospitals, and from others, calls for the emergency truck, and the records show that it is only a matter of a few minutes before the nearest truck is at the scene of any gassing accident or similar occurrence. Usually one of these emergency trucks arrives some minutes before the hospital ambulance. The crews of these trucks are trained not only to make repairs to gas leaks, but also to apply artificial respiration both by means of apparatus and by the manual method, an art in which hospital interns and ambulance surgeons should be thoroughly trained. The truck crews are intelligent men, interested in their work, and with a large experience in cases of gas asphyxiation. Indeed it would be difficult to find a more efficient accident service than that which the Consolidated Gas Company maintains for the benefit of the population of New York City. Furthermore the company placed this organization fully at the service of this investigation. One of the inhalers was carried on each of the five auto trucks and their crews gave efficient and cordial cooperation.

Through the courtesy of the U. S. Bureau of Mines, which is interested in carbon monoxide asphyxia as a cause of fatalities among miners, one of its medical staff was assigned to assist in the investigation. He lived in a room in the Consolidated Building with special telephone connection and automobile service for all hours of the day and night. One or the other, or both of the writers also spent a considerable amount of time with him each week.

The Health Department of New York City also furnished invaluable cooperation by which not only the police but every hospital in the city through its ambulance service and in other respects supplied all the facilities asked for. The authorities of Bellevue Hospital and its pathological department gave particularly valuable assistance.

Methods of Investigation

Even with all this cooperation the difficulties of the investigation inherent in the conditions under which asphyxiations occur in a great city proved to be very

considerable. It is a trying task to wait for days, idle, knowing that a call may come at any minute of the day or night; then to be called at top speed to one end of the city only to find that the case was dead when discovered; to rush back to the other end of the city to find a case spontaneously recovered, and then to arrive late at a case which would have been ideal if fully observed. But even in regard to such cases as that last mentioned, much of value was obtained. Each of the rescue crews was instructed to administer the oxygen + CO_2 inhalation as soon as the hospital ambulance arrives and permission was given by the physician. The amount of evidence regarding the effect of the inhalation so obtained from these physicians and the crews was considerable in addition to that from cases which were directly observed.

Data were obtained regarding a total of 80 cases of asphyxiation; of these half were under such conditions (usually due to delay in discovery) that no treatment was given. They afford, however, valuable control observations. A considerable number also were found dead. Of the remainder some were treated by the methods heretofore in use, and serve as controls on the results obtained with the oxygen + CO_2 inhalation. This inhalation was tried out on 12 severe cases—a number somewhat less than had been hoped for; but in view of the results obtained, they are amply sufficient to justify the investigation and to afford a solid basis for the conclusions to be drawn below.

An elaborate questionnaire was drawn up and mimeographed, and all information obtainable was inserted in regard to each case. In most cases the information reduced itself to more or less definite estimations of the following points: (a) Previous medical history of the victim; (b) physical characteristics, age, weight, etc.; (c) suicide or accident; (d) size of the room, amount of gas and duration of asphyxia; (e) time elapsed before discovery of victim and application of measures for resuscitation (very important); (f) condition of patient at initiation of measures for resuscitation, respiration, pulse rate and force, and particularly a blood sample for analysis of degree of saturation with carbon monoxide; (g) behavior of patient under treatment; (h) condition, physical and mental, and the blood content of carbon monoxide at the end of the treatment—usually 15 to 20 minutes; (i) condition of patient in all respects an hour or two later; (j) next day; (k) subsequently.

Blood Analysis

The method for analyzing the blood for carbon monoxide was the so-called tannic acid method, slightly modified from the procedure which Sayers, O'Brien and Yant have been using (14) at the Bureau of Mines Experiment Station. A finger is wrapped with a rubber band, a deep prick is made with a stiletto, 0.1 cc. of blood is drawn into a pipette. This blood is immediately delivered into a test tube in 0.4 cc. dilute ammonia (1 cc. strong ammonia in a liter of water.) It is essential that the blood and ammonia be immediately mixed so as to lake the sample completely but the mixture must not be shaken or caused to foam. 1.5 cc. of tannic acid (1.0 per cent freshly prepared) are then added and mixed. It takes several hours for the color to develop, or rather for all color not due to carbon monoxide to be converted into the dull brown of the tannated blood proteins. Such samples are read against a scale which must be pre-

pared at practically the same time. For this scale dog's blood is generally used; 5 cc. of the undiluted blood were thoroughly exposed to illuminating gas in a flask by bubbling the gas through the blood until it was completely in foam. 1 cc. of this blood was then laked in dilute ammonia. An equal amount of the original blood without carbon monoxide was similarly mixed with ammonia. By taking proportional amounts of these two solutions, mixing them and adding tannic acid solution, a scale was then prepared in a series of test tubes to show 10, 20, 30, 40, 50, 60 and 100 per cent saturation with carbon monoxide.

The blood from the patient was compared with such a scale the day following. The comparison was always made independently by at least two observers, generally with close agreement in their estimations of the degree of saturation.

It would serve no adequate purpose to report here in detail the 40 cases, of which we obtained records but in which no treatment was given. This group includes nearly all those who were dead when found, as well as those so slightly gassed that nothing needed to be done for them. But two or three general statements are in order.

The observations made by the authors during this investigation indicate that a considerable number of the cases of fatal asphyxia recorded as accidental in the Borough of Manhattan, New York City, are really suicides. The published figures (15) for 1920 report 124 suicides by gas out of a total of 360 suicides; they report also 189 accidental fatal gassings out of a total of 2215 violent deaths; this total including 461 highway fatalities and 367 falls from windows, elevators, etc. In the 313 deaths thus assigned to gas, suicides certainly contributed in reality a much larger proportion and the accidental gassings were correspondingly fewer than these figures show. The average citizen of New York runs a much greater risk of losing his life in a street accident or by a fall from a window or elevator than from asphyxia; and he may reduce the latter risk practically to zero by the exercise of a little care.

In fact a large proportion of accidental fatalities are due to obviously defective fixtures, chiefly cheap, badly made, old, worn, cracked, loose tubing between the gas jet and stoves or burners of various sorts. This is not a matter over which gas companies can exert any control. The state should regulate the manufacture and sale of the types and qualities of such apparatus as the Medical Examiner of New York City, Dr. Charles Norris, (15) has well recommended and as the gas companies of many cities have also urged.

Observations on Cases of Illuminating Gas Poisoning

The outstanding facts established regarding the cases of illuminating gas poisoning to which the oxygen+CO_2 inhalation was applied may be summarized as follows: Not a single case of observable ill effect occurred. Although it did not prove feasible in most cases to administer a preliminary dose of 0.01 grain of atropin the heart was in no case adversely affected by the concentration of CO_2 (5 per cent) used.

In every case the respiratory response to the inhaled CO_2 consisted in a rapid increase in the volume of breathing up to full and deep pulmonary ventilation. Some of these cases were barely breathing and with weak pulse before the inhalation was begun. Some had even to

be started by means of manual artificial respiration. All, however, in whom there was still life responded effectively, and none failed or sank under the inhalation. Frequently the volume of breathing increased within 5 minutes to the full 30 liters of oxygen and CO_2 which is the maximum that the inhaler will supply and beyond which a supplemental volume of atmospheric air is automatically drawn in. In most cases the other vital conditions improved correspondingly.

Most significant was the extremely rapid reduction of carbon monoxide in the blood, the concentration falling from asphyxial amounts to practically negligible percentage saturations (10 or 15 in 15 or 20 minutes.) In several cases the blood was virtually free from carbon monoxide at the end of the inhalation,—a result which is distinctly better even than had been attained in the preliminary experiments on men and animals in the laboratory.

As regards the question of artificial respiration, the observations indicate that in patients whose breathing has stopped or is very feeble, the mask of the oxygen + CO_2 inhaler should be held over the face while manual artificial respiration by the prone pressure method is applied. If any procedure can induce the return of spontaneous breathing after asphyxiation by carbon monoxide this seems most likely to be effective.

In several of the cases of profound asphyxiation, the patients had recovered full consciousness before the end of the 30 or 40 minutes of inhalation. Only one case failed to return to consciousness within an hour or two thereafter. Even more striking is the fact that with this single exception, which died the next day in coma, all of the others made uncomplicated and complete recoveries within a few days.

This is so good a showing that it must be regarded as in part assignable to good luck. There is certainly no reason to expect that every patient asphyxiated for many hours will recover consciousness thereafter merely because all of the carbon monoxide is removed from the blood; the damage to the brain during asphyxiation may be too profound to allow recovery. But the fact that none of the cases developed pneumonia or any of the common sequelae of asphyxia, demonstrates conclusively that the inhalational treatment has no harmful accessory features.

Indeed as regards the pneumonia which is so common, subsequent to gassing, these results suggest that the inhalation treatment may have a distinct prophylactic value. For in one group of 43 cases (other than those observed in this investigation) which survived gassing and recovered consciousness without inhalational treatment, the hospital records (Bellevue) show that 14 (or 33 per cent) developed a subsequent pneumonia, and 10 (or 23 per cent of the total and 70 per cent of the pneumonia cases) died. In striking contrast is the fact that not a single case treated by the inhalation method developed this common post-asphyxial pulmonary complication.

The following cases are typical of the reactions observed during the inhalational treatment:

(a) H. H., female, 23 years, 120 pounds. Gas escaping from open jet; attempted suicide, short but rather intense asphyxiation; probably less than 2 hours in fairly high concentration of gas. The case had been treated with artificial respiration and oxygen apparatus for 20 minutes; blood then contained 45 per cent carbon monoxide. Oxygen + CO_2 inhalation given 10 minutes; blood then

contained 20 per cent carbon monoxide; an hour later, 10 per cent; 4 hours later, the blood was virtually free from carbon monoxide. During inhalation, respiration increased from 7 liters to 30 liters; pulse became strong; color improved; at end of inhalation, patient was conscious, struggling and very angry at being resuscitated; in afternoon had severe headache. Sent to hospital; discharged next day.

(b) M. C., female, 47 years, 140 pounds. Hose to gas jet had been disconnected and gas turned on; time of exposure unknown. When first seen at 4.40 p. m. patient was in coma, respiration 22 full and deep, pulse 98, gool volume and regular. No preliminary blood sample was obtained but from the condition of patient the degree of saturation of the blood with carbon monoxide may be estimated at about 60 per cent. Oxygen + CO_2 inhalation given for 40 minutes, at end of which time she was semiconscious, good pulse, rate 90, respiration 18, regular and fairly deep. At end of inhalation blood showed no perceptible amount of carbon monoxide. Patient sent to hospital and made uneventful recovery.

(c) M. C. C., female, 70 years, 210 pounds; gas jet partly open, accidental; time of exposure unknown; when first seen the patient was in very bad condition, necessitating manual artificial respiration for a few minutes. One of the worst cases in the experience of the observers to make a recovery. Treatment given, atropin sulphate 1-100 grain, oxygen + CO_2 given 30 minutes. No blood sample obtained initially but blood saturation was probably well over 60 per cent; blood sample taken after termination of inhalation showed no perceptible carbon monoxide. Patient was taken to hospital and 3 hours later pulse was strong, 94; respiration regular, 20 per minute. When seen on second day patient was normal mentally and in good physical condition; pulse and respiration regular.

(d) M. P., female, about 40 years, 130 pounds. Open gas jet; attempted suicide; oxygen + CO_2 inhalation administered for 20 minutes; ambulance surgeon reported great improvement; unnecessary to send to hospital.

(e) F. M., female, 76 years. Patient had been found in room with gas jet turned on. There was a delay of some hours in call for treatment, so that part of carbon monoxide had come off, but patient was still comatose. Oxygen + CO_2 inhalation for 20 minutes. Blood before inhalation showed an analysis of 30 per cent saturation with carbon monoxide; after inhalation, 10 per cent.

As an experimental control on these cases it may be mentioned that observations were also obtained on several cases treated with the artificial respiration apparatus heretofore carried by the emergency trucks of the Gas Company. This apparatus supplies oxygen diluted with air. In one case comparable to the above the apparatus was applied for 40 minutes. An hour later a blood sample showed that the blood was still 35 per cent saturated with carbon monoxide and coma continued for 12 hours. Other similar cases were observed. The rate of elimination of carbon monoxide from the blood and of return to consciousness in those cases appeared to be about that which would probably occur if the patients had not been treated at all. Many of the post-asphyxial pneumonia cases above mentioned were those who had been treated with artificial respiration apparatus.

Some Practical Considerations

In the light of the foregoing observations, three topics present themselves for consideration here, namely: artificial respiration, the inhalation treatment, and the subsequent treatment of illuminating gas cases.

(a) Artificial respiration. (16) Laboratory experience on asphyxiated animals teaches that the immediate application of the manual method of artificial respiration is nearly always effective in restoring spontaneous breathing. But even slight delay is fatal. The experience of the emergency crews of the Consolidated Gas Company in a very large number of cases tallies exactly with this laboratory finding. Thus it is their practice when they reach a case which is not breathing for one of the men to apply immediate manual artificial respiration, usually by the prone pressure or Schafer method, while another is preparing the artificial respiration apparatus which they carry. It seems highly probable that more lives are saved by this prompt initial manual treatment than by the apparatus some minutes later. (The general question of the value or lack of value and disadvantages of artificial respiration apparatus will be dealt with in a later report of this Commission.)

Among the various methods of manual artificial respiration the prone pressure method is the most easily applied, affords effective pulmonary ventilation, has no tendency to increase the chance of subsequent pneumonia, and therefore on all of these grounds is best. While one person is applying this treatment, a second may advantageously give the patient an inhalation of oxygen + CO_2. The asphyxial condition is thus counteracted by the oxygen while the CO_2 stimulates the patient's own respiration to spontaneous effort. The method of administering the prone pressure method of artificial respiration should be that shown in the wall chart published by the U. S. Bureau of Mines.

(b) The elimination of carbon monoxide. Once spontaneous breathing has been restored, although the patient may still be deeply comatose, there is no longer need for artificial respiration; it may then be even injurious. This fact might be thought to be obvious were it not so often overlooked in the cases treated with artificial respiration apparatus.

On the whole the inhalation of oxygen + CO_2 used as above described has proved a highly efficient method for inducing rapid elimination of carbon monoxide from the blood. The inhaler employed enables the operator to administer a flow of the oxygen + CO_2 mixture exactly adjusted to the demands of the patient's breathing. Thus these gases may be used most effectively and most economically. The point of economy is important, for an oxygen cylinder of the ordinary portable size when used at the rate of 25 or 30 liters per minute barely holds out for half an hour. It is therefore essential that all of the gas should reach the patient and that the rate of flow should be accurately adjusted. In the light of the observations here reported, it appears unnecessary to prolong the inhalation beyond 30 to 40 minutes.

(c) Subsequent treatment. This is a topic upon which there is great need for additional knowledge. It appears probable that in untreated cases the continuance of coma for hours after the carbon monoxide content in the blood has been reduced to a comparatively unimportant amount has its basis in a condition of oedema of the brain. The thought nat-

urally presents itself in view of the work of Weed (17), Cushing (18) and others, that this condition might be overcome by hypertonic salt solution given intravenously or per rectum.

On the other hand a large proportion of all cases who die a few days subsequently to gassing succumb, not to cerebral injury, but to pneumonia. Measures directed against this risk are more important, that is they are needed by a larger proportion of cases reaching a hospital, than are measures to counteract the conditions of the brain. Experimental work in these fields is being carried on here with some suggestive results regarding the common pulmonary sequelae; but owing to the extremely difficult problems involved, no estimate can be formed as to the probable measure of success. Mention should, however, be made here of valuable work demonstrating brain oedema after asphyxiation now being carried on by Dr. Stanley Cobb and Dr. H. S. Forbes (19) at the Harvard Medical School.

Until more is definitely known regarding conditions subsequent to gassing, the more completely the medical staff of a hospital leave a gassed patient alone and refrain from injections, bleeding transfusions, or other procedures, as yet only vaguely foreshadowed, the greater will be the chance that the patient will not be harmed instead of assisted in recovery.

Empiricism seldom helps and in this field has often killed.

Conclusions

(a) Manual artificial respiration by the prone pressure method should be employed when respiration has stopped to start spontaneous breathing. This object may be assisted by administering oxygen + CO_2 simultaneously.

(b) Inhalation of oxygen and 5 per cent CO_2 by causing a very full ventilation of the lungs rapidly eliminates carbon monoxide from the blood and thus terminates the condition of asphyxia. This treatment is highly effective, inducing rapid and complete recovery, if applied early enough. It requires merely general medical supervision and may be safely and efficiently carried out by intelligent men of the type composing the emergency crews of a city gas company.

(c) Until more definite knowledge has been obtained regarding the conditions in the lungs, brain, and elsewhere, subsequent to gassing, and until treatment can be based upon such knowledge and has been tested experimentally, it is inadvisable to apply any specific treatment to post-asphyxial gassing cases. The evidence here reported indicates that oxygen + CO_2 inhalation and rapid elimination of carbon monoxide greatly decreases the liability to nervous and pulmonary asphyxial sequelae.

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"Note: It has come to our attention that an attempt has been made to substitute in place of the special inhaler which we have developed one of the common artificial respiration devices, namely, the pulmotor. The pulmotor like all other such devices is however entirely unsuited to this purpose and such use of it can do no good and may even do a patient harm. The inhaler attached to the pulmotor is also quite unsuited to the administration of oxygen plus carbon dioxide. The inhaler which we have used was invented by us for the special and peculiar condition of the oxygen carbon dioxide inhalation. No other apparatus now available is capable of functioning as it does and for the present at least no other should be used on our responsibility. Signed—YANDELL HENDERSON, HOWARD W. HAGGARD.

A New Employment Service

An employment service for engineers of every variety of training has been inaugurated by the American Society of Civil Engineers, The American Society of Mechanical Engineers, The American Institute of Electrical Engineers and The American Institute of Mining Engineers under the name of the Engineering Service Bureau of the Federated American Engineering Societies, 29 West 39th St., New York City. This bureau is in the position to supply civil engineers, architects, structural engineers, heating and ventilating engineers, estimators, executors, etc., and its services are free to both employer and employee.

Associations Affiliated with A. G. A.

Canadian Gas Association

Date of Affiliation—Mar. 25, 1919
Pres.—C. S. Bagg, Montreal Light, Heat & Power Co., Montreal, Que.
Sec.-Tr.—G. W. Allen, Consumers' Gas Co., Toronto.
Conv., 1923.

Empire State Gas and Electric Association

Date of Affiliation—Nov. 21 1919
Pres.—E. H. Rosenquest, Bronx Gas & Electric Co., Bronx, N. Y.
Sec.—C. H. B. Chapin, Grand Central Terminal, New York, N. Y.
Conv., Lake Placid, N. Y., Oct. 5-6, 1922.

Illinois Gas Association

Date of Affiliation—Mar. 19, 1919
Pres.—R. S. Wallace, Central Illinois Light Co., Peoria, Ill.
Sec.-Tr.—R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.
Conv., 1923.

Indiana Gas Association

Date of Affiliation—April 24, 1919
Pres.—F. B. Tracy, Central Indiana Gas Co., Muncie, Ind.
Sec.-Tr.—E. J. Burke, Citizens Gas Co., Indianapolis, Ind.
Conv., 1923.

Iowa District Gas Association

Date of Affiliation—May 21, 1919
Pres.—H. B. Maynard, Citizens Gas & Electric Co., Waterloo, Ia.
Sec.-Tr.—H. R. Sterrett, Des Moines Gas Co., Des Moines, Ia.
Conv., 1923.

Michigan Gas Association

Date of Affiliation—Sept. 18, 1919
Pres.—J. A. Brown, Hodenpyl, Hardy & Co., Jackson, Mich.
Sec.-Tr.—A. G. Schroeder, Grand Rapids Gas Light Co., Grand Rapids, Mich.
Conv., Detroit, Mich., September 13th, 14th, 15th, 16th, 1922.

Missouri Association of Public Utilities

Date of Affiliation—June 18, 1920
Pres.—E. R. Locke, Missouri Utilities Co., Mexico, Missouri.
Sec.-Tr.—F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.
Wiley F. Corl, Chmn. Affiliation Com., Missouri Utilities Co., Mexico, Mo.
Conv., 1923.

New England Association of Gas Engineers

Date of Affiliation—Feb. 19, 1919
Pres.—V. E. Bird, Connecticut Power Co., New London, Conn.
Sec.-Tr.—J. L. Tudbury, Salem Gas Light Co., Salem, Mass.
Conv., 1923.

Gas Sales Association of New England

Date of Affiliation—Oct. 1, 1919
Gov.—F. A. Woodhead, Arlington Gas Light Co., Arlington, Mass.
Sec.—M. Bernard Webber, 150 Congress St., Boston, Mass.
Annual Meeting, 1923.

New Jersey Gas Association

Date of Affiliation—April 25, 1919
Pres.—Jacob B. Jones, Bridgeton Gas Light Co., Bridgeton, N. J.
Sec.-Tr.—H. E. Mason, Consolidated Gas Co. of N. J. Long Branch, N. J.
Conv., 1923.

Pacific Coast Gas Association

Date of Affiliation—Sept. 18, 1919
Pres.—Henry Bostwick, Pacific Gas & Electric Co., San Francisco, Cal.
Sec.-Tr.—W. M. Henderson, 812 Howard St., San Francisco, Cal.
Conv., Santa Barbara, Cal., September, 19-22, 1922.

Pennsylvania Gas Association

Date of Affiliation—April 10, 1919
Pres.—Luther Gaston, Lebanon Gas & Fuel Co., Lebanon, Pa.
Sec.-Tr.—Geo. L. Cullen, Harrisburg Gas Co., Harrisburg, Pa.
Conv., 1923.

South Central Gas Association

Date of Affiliation—Oct. 15, 1919
Pres.—Frank L. Weisser, San Antonio Public Service Co., San Antonio, Texas.
Sec.-Tr.—S. J. Ballinger, San Antonio Public Service Co., San Antonio, Texas.
Conv., Hot Springs, Ark., Oct. 10-11-12, 1922.

Southern Gas Association

Date of Affiliation—May 20, 1919
Pres.—P. H. Gadsden, The United Gas Improvement Co., Philadelphia, Pa.
Sec.-Tr.—G. H. Smith, City Gas Co., Norfolk, Va.
Conv., 1923.

Wisconsin Utilities Association

Pres.—J. P. Pulliam, Wisconsin Public Service Co., Milwaukee, Wis.
Exec.-Sec.J. N. Cadby, 445 Washington Bldg., Madison, Wis.
Conv., 1923.

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Rate Structure—J. D. SHATTUCK, Chester, Pa.
Standard Gas Appliance Specifications—W. T. RASCH, New York, N. Y.
United States National Committee of the International Commission on Illumination, Representative on—HOWARD LYON, Gloucester, N. J.
Nominating—A. P. Lathrop, New York, N. Y.

Customers' Service

The admirable discussion of Mr. G. I. Vincent on the report of the Committee on Customers' Service was printed in the Proceedings and in now giving the discussion in full we believe it will serve to redirect attention to one of the most valuable reports presented at the 1921 meeting, which report is covered in full on pages 186-204 of the 1921 General Proceedings.—(EDITOR'S NOTE.)

UNDOUBTEDLY, this is by far the best exposition of this ever present subject of service we have ever heard. Now what are we going to do about it? Shall we approve, and congratulate the committee, and then go home and forget it? In that event, all the time of the committee and all the time allotted to it in this session will have been wasted. Any one of us, no matter how well we think our properties are operated, will do well to read this report again. It is full of meat. Then note carefully if the standards of good service, so well detailed, have been reached in all our departments. And even in the doubtful event that we find we have qualified on all counts, it is not the final answer. I, for one, feel that we could go much further along some lines. If I may repeat what I have said several times before, I would point out that we are overlooking some good bets in improving our public relations. Most of us I think are backward in three most important attributes in this service we talk so much about.

1. Promptness of service
2. Completeness of service
3. The personal touch

Taking the last attribute first, the thought is that frequent contact between high-grade employees and the customers can be developed in such a way that the employee would gradually become personally acquainted with his customers. Surely this would gradually wean the customer's mind away from the "Soulless Corporation" idea because his contact would have become a personal entity, with mutual liking and respect.

This suggestion of a method of augmenting the friendship between the utility and its customers has already been outlined in a committee report last year as the "Bill Jones Idea." One-half of this idea, that is, the customer's premises work, is not open to discussion because it is already functioning well and with splendid promise of improvement in several live wire utilities.

The "Bill Jones Idea" not only develops the personal touch to the maximum but leads at once to my other thoughts on good service—Completeness and Promptness. The all-service method, of course, insures completeness at one visit. It should and can insure promptness. I may be a crank on this matter but I do believe that infinite good will can be gained by exceedingly high speed service. And promptness in service is a relative thing. Inter-departmental cooperation is necessary to the last degree. If it requires three hours for a competent man to reach the customer's premises after receipt of an order in the order executing department, it would be called first class service. But if that same order had required two or three days to sift through the red tape of the order-taking department, it would be rotten service. And again speaking relatively, the high standard of three hours maximum between receipt of an order and beginning work in the order executing department, should be equivalent to about fifteen minutes allowable time through the entire order taking department. We must not forget that we are in competition in our service with the highly efficient delivery systems of the modern department store. The fact that our work is far more intricate and exacting has nothing to do with it. The comparison will be made right there in our customer's mind. Now this should be of interest. I believe, in fact I know, that the time of order taking and executing can be speeded up to a point that it will be beyond competition in the community. And this with negligible increase in operating costs.

This, then, is my thought. The competent man, operating always in his own district, answering calls almost instantly, completing on one visit every thing the customer may desire, and seeing his customer as often as possible.

If I am right in my analysis of this problem it would seem to me that we must do more to bring our employees in contact with our customers. That would seem to imply that we must do more merchandising. Not only must we sell our appliances that use gas but we should sell everything that can be utilized even remotely in the use of gas. This system of service that I have outlined can readily be worked into a high-speed delivery system and everything we sell will bring a competent employee in contact with the customer. Now, further, the more we sell, the more articles we sell, the lower our overhead, the more our profit and the more money we will have for advertising. Mr. Parlin said day before yesterday, the secret of good advertising is to advertise something that is good. We are going to advertise good service, and then give super-service. We can advertise all the time, so that our name and good service will be always before our customers. It is a "fat" time to rush into print when you are in trouble, but with the name of the gas company constantly before the customers, when we do get in trouble, when the demagog starts something, we are absolutely certain to get at least a fair hearing.

ACCOUNTING SECTION

EWALD HAASE, Chairman — J. W. HEINS, Vice-Chairman

H. W. HARTMAN, Secretary

MANAGING COMMITTEE—1922

At Large

DAVIDSON, H. C., New York, N. Y.
DOERING, W. A., Boston, Mass.
LA WALL, H. J., Philadelphia, Pa.
LAWRENSON, JAMES, New York, N. Y.
MEYER, W. J., New York, N. Y.
PETTES, W. H., Newark, N. J.
SAUER, W. A., Chicago, Ill.
SCHMIDT, JR., WM., Baltimore, Md.
SCOBELL, E. C., Rochester, N. Y.
SMART, BURTON, Portland, Me.
STERRETT, W. G., Chester, Pa.
WILSON, P. A., Philadelphia, Pa.

Representing Affiliated Societies

ARMSTRONG, J. J., Toronto, Can. (Canadian)
BORDEN, A. W., Hastings, Nebr. (Iowa)
DEAL, E. C., Springfield, Mo. (Missouri)
HAASE, EWALD, Milwaukee, Wis. (Wisconsin)
HOUGHTON, W. E., Los Angeles, Cal. (Pacific Coast)
HOY, CHAS. W., Glassboro, N. J. (New Jersey)
JAMES, F. M., Aurora, Ill. (Illinois)
McCABE, J. B., Dallas, Tex. (South Central)
NORTON, W. F., Nashua, N. H. (N. E. Gas Eng.)
PORTER, EDW., Philadelphia, Pa. (Pennsylvania)
SCOBELL, E. C., Rochester, N. Y. (Empire State G. & E.)
SHEARON, B. P., Hammond, Ind. (Indiana)
STOTHART, E. C., Charleston, S. C. (Southern)
SWANSON, J. K., Jackson, Mich. (Michigan)

CHAIRMEN OF SECTION COMMITTEES ORGANIZED TO DATE

Consumers Accounting—W. A. DOERING, Boston, Mass.
Continuous Inventory of Fixed Capital—H. C. DAVIDSON, New York, N. Y.
Fire Insurance Rates—P. A. WILSON, Philadelphia, Pa.
Nominating—W. H. PETTES, Newark, N. J.
Standard Classification of Accounts—W. J. MEYERS, New York, N. Y.
State Representatives—W. A. SAUER, Chicago, Ill.

The Explosion of Gas and the Fire Insurance Policy

THE work of the Committee on Fire Insurance rates as developed so far this year indicates that no fire insurance is carried by a number of gas companies on their gas plants, and that many others carry but a nominal amount, the reason being that the plants are of non-combustible construction, and, therefore, it is impossible to have a fire.

The explosion of gas, however, is an ever present possibility, which cannot be prevented by good construction (in fact the better the construction the more serious the loss in many instances) and it should be understood that the explosion hazard, as well as the ordinary fire hazard may be covered by the regular fire insurance policy.

It is customary, and permissible under the new schedule for the rating of gas plants, to insert a clause on the form attached to the policy reading somewhat as follows:

"It is understood and agreed that, in construing the terms and conditions of this policy, the ignition of gas or vapor in or about the premises described herein shall be regarded as 'fire' and the loss resulting therefrom shall be adjusted and paid in the same manner as if otherwise occasioned."

This clause has been criticized as adding nothing to the fire insurance policy for the reason that if ignition of gas should occur you would have a fire loss, and that, therefore, the ordinary fire insurance policy would apply without the use of any special clause. That, however, is not so. The fire hazard covered by the ordinary fire policy is the hazard

of a destructive and consuming fire, but it is quite possible to have other forms of "fire," not destructive in their nature, called "friendly" fires in insurance parlance, which nevertheless could cause the explosion of gas, such as an open-flame light, a spark, or a lighted match. The importance of using the explosion clause can well be appreciated. Without it a "friendly" fire could cause the ignition of gas and a consequent explosion, without any destructive fire being present whatever, and there would be no recovery from the insurance company, as the printed conditions of the fire policy expressly exclude losses from explosion unless fire ensues, and then covers the damage caused by fire only.

A so-called explosion clause has come to the attention of the writer which said that the explosion of gas was covered if the explosion was caused by fire (which must be assumed to mean a destructive fire) which is not the same thing as "the ignition of gas or vapor" as used in the clause recommended. If the explosion was caused by a destructive fire it would be covered whether the explosion clause was used or not. In other words, if a destructive fire causes an explosion, the loss is covered by the regular fire insurance policy, explosion clause or no explosion clause, but if an explosion causes a fire the fire loss only is covered under the ordinary policy, unless the clause is used which covers the ignition of gas or vapor. The use of a clause covering explosions caused by fire (meaning a destructive fire) not only adds nothing to the value of the policy, but gives the impression of covering the explosion hazard when it does nothing of the kind.

In some underwriting jurisdictions it has been customary to make a charge of from 5c to 10c for the use of the explosion clause. While it is considered advisable to pay this additional charge for the protection, the insurance companies in most jurisdictions are permitting the use of the explosion clause without charge, and this should be universally done, unless some regulation of the State Insurance. Department makes it impossible to do so, which may be the case in some States.

In Memoriam

The gas industry experienced a decided loss in the death of Frank W. Frueauff, junior partner of Henry L. Doherty & Company and vice-president of the Cities Service Company. Mr. Frueauff died suddenly at his home in New York City, Monday, July 31. Born in Columbia, Pa., he identified himself with the gas and electric industry after graduation from high school and from that day made these public utilities his life work.

ADVERTISING SECTION

A. A. HIGGINS, Chairman — B. J. MULLANEY, Vice-Chairman

CHARLES W. PERSON, Secretary

MANAGING COMMITTEE—1922

At Large

BENEDICT, C. M., Des Moines, Ia.
BENNETT, J. M., Philadelphia, Pa.
HANLAN, J. P., Newark, N. J.
HUMM, A. W., New York City, N. Y.
MURFIT, W. G., Newtown, Pa.
NEWTON, F. A., Jackson, Michigan.
POTTER, CLYDE H., Los Angeles, Cal.
WELSH, W. J., Stapleton, N. Y.
WISKE, P. B., Brooklyn, N. Y.

Representing Affiliated Societies

ALLEN, GEO. W., Toronto, Can. (Canadian)
BURNS, J. J., St. Louis, Mo. (Missouri)
CHAPIN, C. H. B., New York, N. Y. (Empire State Gas & Electric Association)
FRANKLIN, S. J., Millville, N. J. (New Jersey)
FUGATE, FRANK, Detroit, Mich. (Michigan)
GOULD, WM., Boston, Mass. (N. E. Gas Eng.)
HARTOG, JOHN H., Portland, Ore. (Pacific Coast)
JASPERSON, R. O., Chicago, Ill. (Wisconsin)
LESTER, F. M., Chicago, Ill. (Illinois)
ENGLISH, A. L., Council Bluffs, Ia. (Iowa District)
MULHOLLAND, S. E., Fort Wayne, Ind. (Indiana)
ROLSTON, R. J., Philadelphia, Pa. (Pennsylvania)
TILLERY, P. A., Raleigh, N. C. (Southern)

Seize this Opportunity to Create Good Will

The following article in letter form was mailed to our gas company members on August 7. The suggestions offered will hold good even if the coal strike is called off before this is printed, because there will be a fuel shortage for months to come. (EDITOR'S NOTE.)

RIGHT now, during the present coal crisis, is the time for the gas industry to come out publicly in the daily newspapers of the country and sell itself and its indispensable service to the American people.

Now is the time for the industry to drive home the fact to the American people that it is a 365¼ day, an 8,766-hour-a-year business, and that gas fires never go out, winter or summer, good times or bad times, strikes or no strikes.

We have always been an under-advertised business. Let us seize today's opportunity and put *Uninterrupted Gas Service* on the map in letters so large that it cannot be ignored.

Conditions are ideal for such a move—we may never again witness others so favorable. The newspapers are openly receptive. Public sentiment is right. Everything is in our favor.

How to take advantage of this opportunity is simple enough if you will think in terms of newspaper publicity and newspaper advertising, and use those two methods for making your voice heard. Here are a few suggestions which may help:

1. *Get every inch of newspaper publicity that you can.* Some one in your organization should be entrusted personally to deal with the press in order that the newspapers may not be referred from one person or department to another when they telephone or call for information.

2. *Treat all newspapers alike.* Keep editors fully informed of all developments. Save them the trouble of "digging-up" facts about your company by volunteering these facts to them in advance. When reporters call see them promptly.

3. *Permit yourself to be quoted* in order that there may be some human, personal touch to news about your company.

4. *Facts* like amount of coal on hand, number of days it will last, amount of coal ordered, where coal is mined, daily gas output, increase or decrease over last month or last year, number of customers, meters, ranges, water heaters, miles of mains, new customers added and other statistics will be real news now that your company is in the public limelight.

5. *Photographs* tell a better story than words. If a new carload of coal arrives, tip off your editors and furnish them with photographs of it. Photograph your present stock of coal, your coal handling machinery, etc., and work in some interesting facts in the captions to accompany the photographs.

6. *Advertise persistently,* contracting for an average of three advertisements a week. If possible, secure a preferred position that attracts attention and stick to it. It is not necessary to use large space or illustrations. One or two columns wide by six inches deep is sufficient. A distinctive style of border or type will serve to set off your advertisements from the others.

7. *Talk gas service first, last and all the time.* Make your copy timely by tying it up with coal news developments. Then hammer away on the convenience of gas, its cleanliness, economy, reliability, etc., etc. In every advertisement play up the phrase in big letters: UNINTERRUPTED SERVICE.

8. *Show the public that "gas is coal with a college education."* Tell them what happens to a ton of coal when it goes into the retort house. Point out the damage that smoke is doing to health, industry, household effects, etc., etc. Keep shouting the fact that gas service is helping us all to have a pleasanter place to live and enjoy the good health that goes with a pure, wholesame atmosphere.

9. *Finally, we have just the kind of advertising material that will help you.*

Our good will and chat advertising copy will be invaluable to you. Some advertisements can be used as they are; others can be changed slightly to fit conditions. They are free. Ask for them.

Life is not so short but that there is always time enough for courtesy.

—Emerson.

Good News for Advertising Men

W. P. STRANDBORG, Vice President, Associated Advertising Clubs of the World; Publicity Agent, Portland (Oregon) Railway, Light and Power Company.

THE great public utilities of the country will probably be banded together into one closely-knit organization for the more systematic and businesslike handling of all publicity and advertising problems within the next few months. Preliminary steps to that end were recently taken at a conference in Milwaukee, co-incident with the annual convention of the Associated Advertising Clubs of the World.

The advertising and publicity departments of a large number of individual public utilities—electric railway, gas, light and power, and telephone interests were represented at this conference and it was unanimously agreed to proceed at once with plans for organization on a permanent basis.

The new organization will probably be known as the Public Utility Advertising Association and will be open to the advertising sections of the American Electric Railway Association, National Electric Light Association, American Gas Association, the American Telephone and Telegraph Company, and the independent telephone interests, as well as to the various state committees on public utility information, and individual companies engaged in any one of the four major utilities mentioned. Plans are also under way for admitting individuals, corporations and firms engaged in public service. In other words, it is intended to have represented in the new association the full and united strength of the entire public utility industry.

An organization committee was selected at the Milwaukee conference, with the writer as chairman. Associated with him will be three members representing the three national utility associations, and one member at large from the electric railways, gas, light and power, Bell and independent telephone companies.

This committee will meet to perfect the permanent organization during the coming sessions of the American Electric Railway Association convention in Chicago, the first week of October. The next step will be the adoption of a constitution and "Standards of Practice" with a view of seeking membership for the new association in the Associated Advertising Clubs as a distinct Public Utility Department.

The purposes and objects of the new organization as set forth in the tentative "Standards of Practice" to be submitted at the next meeting are as follows:

STANDARDS OF PRACTICE

Realizing our obligation and responsibility to the public, to the seller of advertising service, the advertising agent and our own organization, we, as general advertisers, pledge ourselves as follows:

1. To consider the interests of the public foremost, and particularly that portion thereof which we serve.

2. To claim no more, but if anything a little less, in our advertising than we can deliver.

3. To refrain from statements in our advertising which, through actual mis-

representation, through ambiguity or through incompleteness, are likely to be misleading to the public, or unjust to competitors.

4. To use every possible means, not only in our own individual advertising but by association and co-operation, to increase the public's confidence in advertised statements.

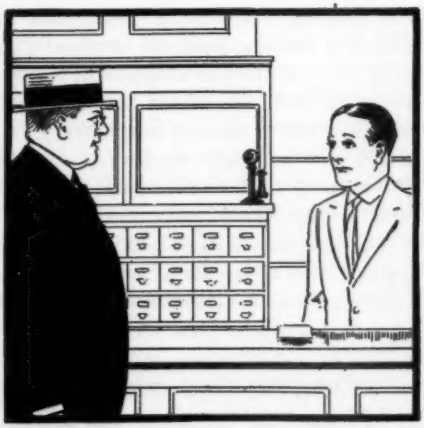
5. To refrain from attacking competitors in our advertising.

6. To refrain from imposing upon the seller of advertising service unjust, unreasonable and unnecessarily irksome requirements.

7. To furnish to publishers, when requested, technical information which will help them keep reading pages and advertising colums free from misstatements.

8. To refrain from and discourage deceptive or coercive methods in securing free advertising, and to do everything possible to aid the publisher to keep his colums free and independent.

9. To require standards for ourselves equal to those we set for others.



THE INDIFFERENT PUBLIC SERVICE COMPANY'S Application Counter Clerk meets the customer in an indifferent manner. After asking a number of questions and repeating the name and address a number of times the application is taken, the clerk turning his back and walking away with the papers to the line order clerk. He shows little interest at any time.

Result: Unsatisfactory Public Service, Dissatisfied Customers and Unhappy Employees.

THE GOOD PUBLIC SERVICE COMPANY'S Application Counter Clerk addresses the customer with a cheery "Good morning." He takes the application in a business-like manner, assures the customer that the order will be executed promptly, and, of course, expresses the gratification of the Company in having Mr. Blank as a customer.

Result: Good Public Service, Satisfied Customers and Happy Employees.

Nearly 200 Companies Subscribe to Advertising Service

AT this writing approximately two hundred gas company members of the Association have subscribed to the A. G. A. Advertising Copy Service, the first issue of which will be distributed October first.

As previously announced in these pages, the new advertising service will combine under one cover each month sufficient ideas, copy matter and illustrations to enable a company to maintain a fairly comprehensive advertising record. For example, each monthly issue will consist of eight illustrated appliance —selling advertisements set up in three different sizes; one illustrated good-will advertisement, and four single column Chat Advertisements. An unusual feature of the service will be that matrices of all illustrations will be included free with the copy matter. An entire year's service, therefore, will consist of 96 pieces of appliance—selling copy, 96 matrices reproducing original illustrations to accompany the copy, 12 pieces of good-will advertising copy, 12 matrices reproducing good-will illustrations, and 48 pieces of "Chat" advertising copy.

The total annual cost of the service is $60.00, payable quarterly in advance. This is less than the price often asked by an artist for two original illustrations, yet the Association will supply 96 such illustrations.

Companies should take advantage of this generous offer and line up with a movement that is timely and bound to stimulate sales. Send in your subscription immediately. Do not miss the first issue.

Getting the Newspaper Point of View

F. A. NEWTON, Jackson, Michigan

I SHOULD say that if there was any criticism I would make of public utility managers generally it is that they do not get the newspaper point of view at all. They either want the newspapers entirely for them or want them to shut up. The newspaper business is one business and the public utility business is another. They are not run the same way and they are not going to be. There are people in charge of newspapers who act very foolishly at times just like people in charge of public utilities, but take the newspaper men as a class and I am convinced they are just as honest and just as intelligent as public utility men as a class. One thing I think that public utility men do not appreciate and that is that newspapers do not make news, they gather news. If public utilities want newspapers to print news about public utilities they have got to make the news for them, or lead them to it, and there is plenty of news in public utility offices if the managers only recognize it as such.

Bar Association Opposes Bacharach Bill

At its national convention held in San Francisco August 7 to 11, the American Bar Association went definitely on record in opposition to the Bacharach Bill and to all other legislation of similar type. At a meeting of the Public Utility Section of the Association on August 8, the following resolution was adopted:

> "RESOLVED, That the Section on Public Utility Law of the American Bar Association hereby expresses the emphatic opposition of its membership to the Bacharach Bill now pending in Congress (HR 10212) and to any similar legislation designed to limit or destroy, as to any particular class of litigants or rights, the present equitable powers of the Federal courts to enforce the guaranties of the Federal Constitution for the protection of persons and property.
>
> "RESOLVED, Further, That the Section asks its chairman in his report to the Association to present at least in outline the considerations which have been developed in the discussions before the Section as demonstrating the extreme unwisdom of any such radical curtailment of the Federal judicial power.
>
> "RESOLVED, Further, That the Chairman of this Section and the special committee created at today's session are authorized in behalf of the Section to take such further steps as in their judgment may be advisable to bring about an endorsement by the Association of the action of its Committee on Jurisprudence and Law Reform in actively opposing the Bacharach Bill at the present session of the Congress, and also to support before the Association any suitable resolutions which may be offered in condemnation of that or similar legislation."

At the general session of the Association Thursday, August 10th, the Committee of Jurisprudence and Law Reform presented its report, Mr. Henry W. Taft, chairman, including as a part of that report the resolution adopted by the Public Utility Section and expressing definite opposition to the Bacharach Bill as follows:

> "Three hearings have been had upon this bill. At one of these a member of this Committee, Mr. Harriman, attended and pointed out the objections to it upon the grounds referred to in these previous reports. The chairman also presented a similar statement. After considering the subject carefully this committee unanimously voted that it disapproved the bill. Information as to this vote has been presented to the Judiciary Committee of the House, which has had the matter under consideration."

The Committee report was unanimously adopted by the Association.

MANUFACTURERS SECTION

JOHN S. DeHART, Jr., Chairman — F. A. LEMKE, Vice-Chairman

C. W. BERGHORN, Jr., Secretary

MANAGING COMMITTEE—1922

At Large

BAILL, A. P., Pittsburgh, Pa.
CLOW, K. S., Chicago, Ill.
COLLINS, D. J., Philadelphia, Pa.
CRANE, WM. M., New York, N. Y.
DEHART, JR., JOHN S., Newark, N. J.
DICKEY, C. H., New York, N. Y.
FERRIS, E. J., New York, N. Y.
GREENE, J. J., New York, N. Y.
GRIBBEL, W. GRIFFIN, Philadelphia, Pa.
KNAPP, F. H., Pittsburgh, Pa.
KOPPER, WM. B., Brooklyn, N. Y.
LEMKE, F. A., Kalamazoo, Mich.
McDONALD, DONALD, New York, N. Y.
ROPER, GEORGE D., Rockford, Ill.
SHERWOOD, J. M., New York, N. Y.
STITES, TOWNSEND, Gloucester, N. J.

Affiliated Representatives

GIBSON, W. R., Toronto, Can. (Canadian)
MILLER, THOMAS D., Detroit, Mich. (Illinois)
WESTON, J. A., Lansing, Mich. (Indiana)
ROPER, GEORGE D., Rockford, Ill. (Iowa Dist.)
SCHALL, H. D., Detroit, Mich. (Michigan)
KELSEY, L. D., Brookfield, Mo. (Missouri)
NORTON, ARTHUR E., Boston, Mass. (N. E. Gas Eng.)
BARTLETT, C. E. (New Jersey)
EGLESTON, G. P., San Francisco, Calif. (Pacific Coast)
BARTLETT, C. E., Philadelphia, Pa. (Pennsylvania)
SEIDENGLANZ, C. H., Dallas, Tex. (So. Central)
SPARKS, F. F., Chattanooga, Tenn. (Southern)
McCULLOUGH, CHARLES, Milwaukee, Wisc. (Wisconsin)

CHAIRMEN OF SECTION COMMITTEES ORGANIZED TO DATE

Exhibition—JOHN S. DEHART, JR., Newark, N. J.
Nominating—GEORGE D. ROPER, Rockford, Ill.
Division of Accessories Manufacturers—J. M. SHERWOOD, New York, N. Y.
Division of Apparatus and Works Manufacturers—D. J. COLLINS, Philadelphia, Pa.
Division of Gas Range Manufacturers—WM. M. CRANE, New York, N. Y.
Division of Heating Appliance Manufacturers—K. S. CLOW, Chicago, Ill.
Division of Industrial Appliance Manufacturers—WM. B. KOPPER, Brooklyn, N. Y.
Division of Lighting Appliance Manufacturers—TOWNSEND STITES, Gloucester, N. J.
Division of Meter Manufacturers—DONALD McDONALD, New York, N. Y.
Division of Office Labor Saving Devices Manufacturers—E. J. FERRIS, New York, N. Y.
Division of Water Heater Manufacturers—A. P. BAILL, Pittsburgh, Pa.
Division of Supply Manufacturers—J. J. GREENE, New York, N. Y.

Allotment of Exhibition Spaces

The following list of allocations of exhibition spaces is published for the information of our member companies. (EDITOR'S NOTE.)

Company	*Exhibition Space*
A-B Stove Co., Battle Creek, Mich.	33, 34
Acme Brass Works, Detroit, Mich.	138
American Gas Association, Acc't Sec't, N. Y. C.	252
American Gas Journal, N. Y. C.	210
American Meter Co., N. Y. C.	231, 241
American Radiator Co., Chicago, Ill.	15
American Range & Foundry Co., Minneapolis, Minn.	135
Armstrong Cork & Insulation Co., Pittsburgh, Pa.	137
Atlantic Tubing Co., Providence, R. I.	7
Bailey Meter Co., Cleveland, O.	234
The Baltimore Enamel & Novelty Co., Baltimore, Md.	11
The Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.	31
The Bartlett Hayward Co., Baltimore, Md.	130
Bastian-Morley Co., La Porte, Ind.	126
R. H. Beaumont Co., Philadelphia, Pa.	120
The G. S. Blodgett Co., Burlington, Vt.	220
The Bryant Heater & Mfg. Co., Cleveland, O.	218

Chambers Mfg. Co., Shelbyville, Ind. 249
Chicago Vitreous Enamel Product Co., Cicero, Ill. 228
Geo. M. Clark & Co. Div. Amer. Stove Co., Chicago, Ill. 29, 30
Claus Automatic Gas Cock Co., Milwaukee, Wis. 205
Cleveland Gas Meter Co., Cleveland, O. 105
The Cleveland Heater Co.. Cleveland, O. 139, 140
James B. Clow & Sons, Chicago, Ill. 18
Commercial Gas Appliance Co., Philadelphia, Pa. 256
Connelly Iron Sponge & Governor Co., N. Y. C. 202
Connersville Blower Co., Connersville, Ind. 240
Wm. M. Crane Co., N. Y. C. ..... 39 to 44
Cribben and Sexton Co., Chicago, Ill. 48
Cruse-Kemper Co., Ambler, Pa. 201
Cutler-Hammer Mfg. Co., N. Y. C. 112, 113

Dangler Stove Co. Div. Amer. Stove Co., Cleveland, O. 25
M. T. Davidson Co., N. Y. C. 223
Detroit Stove Works, Detroit, Mich. 13
S. R. Dresser Mfg. Co., Bradford, Pa. 224

Elliott-Fisher Company, N. Y. C. 250
Equitable Meter Co., Pittsburgh, Pa. 255
Eriez Stove & Mfg. Co., Erie, Pa. 26
The Estate Stove Co., Hamilton, O. 3

The Foxboro Co., Inc., Foxboro, Mass. 145

The Gas-Age Record, Chicago, Ill. & N. Y. C. 208
The Gas Industry, Buffalo, N. Y. 209
The Gas Machinery Co., Cleveland, O. 213
Gas Purifying Materials Co., Long Island City, N. Y. 206
General Gas Appliance Co., N. Y. C. 32
General Gas Light Co., Kalamazoo, Mich. 9, 10
Go-Ro Incorporated, New Orleans, La. 111
The J. H. Grayson Mfg. Co., Athens, O. 47
John J. Griffin & Co., Philadelphia, Pa. 232

Hays Mfg Co., Erie, Pa. 222
Helme & McIlhenny, Philadelphia, Pa. 233
The Hoffman Heater Co., Lorain, O 118
Humphrey Co. Div. Ruud Mfg. Co., Kalamazoo, Mich. 129

The Intercolonial Gas Journal of Canada, Hamilton, Canada 207
The Improved Appliance Co., Brooklyn, N. Y. 117
Isbell-Porter Co., Newark, N. J. 200

Johns-Manville, Inc., N. Y. C. 211

Kalamazoo Loose Leaf Binder Co., Kalamazoo, Mich. 253
Kennedy-Toombs, Inc., N. Y. C. 23, 24
The Kompak Co., New Brunswick, N. J. 106
The Koppers Co., Pittsburgh, Pa. 128

Lambert Meter Co., Inc., Brooklyn, N. Y. 235
The Lattimer Stevens Co., Columbus, O. 221
The Lovekin Water Heater Co., Philadelphia, Pa. 109

D. McDonald & Co., Albany, N. Y. 231, 241
Maryland Meter Works, Baltimore, Md. 231, 241

Metric Metal Works, Erie, Pa. 242
The Michigan Stove Co., Detroit, Mich. 46
Milwaukee Gas Specialty Co., Milwaukee, Wis. 17
Mine Safety Appliances Co., Pittsburgh, Pa. 254
H. Mueller Mfg. Co., Decatur, Ill. 103

National Stove Co., Div. Amer. Stove Co., Lorain, O. 35
National Tube Co., Pittsburgh, Pa. 203, 204
New Process Stove Co., Div. Amer. Stove Co., Cleveland, O. 21
The 1900 Washer Co., Binghamton, N. Y. 100, 101

The Peninsular Stove Co., Detroit, Mich. 4
Phillips & Clark Stove Co., Geneva, N. Y. 110
Pittsburgh Meter Co., Pittsburgh, Pa. 245
Pittsburg Water Heater Co., Pittsburgh, Pa. 116, 125

Quick Meal Stove Co., Div. Amer Stove Co., St. Louis, Mo. 5
Quigley Furnace Specialties Co., N. Y. C. 217

Rathbone, Sard & Co., Albany, N. Y. 38

Reliable Stove Co., Div. Amer. Stove Co., Cleveland, O. 6
Remington Typewriter Co., Inc., N. Y. C. 251
Republic Flow Meters Co., Chicago, Ill. 236
Reznor Mfg. Co., Mercer, Pa. 142
Riter Conley Co., Pittsburgh, Pa. 214
The Roberts Brass Mfg. Co., Detroit, Mich. 229
Roberts & Mander Stove Co., Philadelphia, Pa. 132, 133, 134
Robertshaw Mfg. Co., Youngwood, Pa. 22
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Meeting of Division of Meter Manufacturers

At a meeting held at Association headquarters on July 18, it was resolved to send the following letter to all meter manufacturers:

"The Technical Section of the American Gas Association has created a committee to chemically examine the deposits in consumers' meters with a view to ascertaining what plant conditions or what manufacturing methods may be expected to result disastrously for the meter.

"A laboratory has been established at 319 Arch Street, Philadelphia, in charge of Mr. Ralph H. Brown, formerly of the Bureau of Mines, who has been engaged for this research.

"It is requested that all manufacturers of gas meters prepare and forward to Mr. Brown a careful and full description of the characteristics of meters sent to them for repair with particular reference to condensation found and the apparent resultant reactions therefrom coupled with the name of the gas company in each case.

"This information will be of considerable assistance to the Committee as it will be followed up in person by Mr. Brown in his effort to identify particular meter deterioration with specific plant conditions and methods of gas manufacture."

Classified Directory—Manufacturers of Gas Equipment

Company Members Only, American Gas Association, Inc.

ARC LAMPS (Gas)
General Gas Light Co., New York, N. Y., Kalamazoo, Mich.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Welsbach Co., Gloucester, N. J.

ASBESTOS AND MAGNESIA PRODUCTS
Johns-Manville Inc., Madison Ave. and 41st St., New York, N. Y.

BAGS (Gas Main)
Safety Gas Main Stopper Co., 523 Atlantic Ave., Brooklyn, N. Y.

BENCHES
Bartlett Hayward Co., The, Baltimore, Md.
Gas Machinery Co., Inc., The, Cleveland, Ohio
J. H. Gautier & Co., Jersey City, N. J.
Missouri Fire Brick Co., St. Louis, Mo.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Riter-Conley Co., Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.

BENCH IRON WORK
Banner Iron Works, 4560 Shaw Ave., St. Louis, Mo.
Bartlett Hayward Co., The, Baltimore, Md.
Davis & Farnum Mfg. Co., Waltham, Mass.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Improved Equipment Co., The, 24 State St., New York, N. Y.
Isbell-Porter Co., Newark, N. J.
Missouri Fire Brick Co., St. Louis, Mo.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Riter-Conley Company, Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
Stacey Manufacturing Co., The, Cincinnati, Ohio.
Western Gas Construction Co., The, Fort Wayne, Ind.

BLAST GATES
Steere Engineering Co., Detroit, Mich.
B. F. Sturtevant Co., Inc., Boston, Mass.

BLOWERS, BOOSTERS, EXHAUSTERS
American Gas Construction Co., Newton, Ia.
American Gas Furnace Co., Elizabeth, N. J.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Isbell-Porter Co., Newark, N. J.
C. M. Kemp Mfg. Co., The, Baltimore, Md.
Maxon Furnace and Engineering Co., Muncie, Ind.
Monarch Engineering & Mfg. Co., American Bldg., B. 'imore, Md.
Russell Engineering Co., St. Louis, Mo.
Needham Gas Appliance Co., The Passaic, N. J.
B. F. Sturtevant Company, Hyde Park District, Boston, Mass.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.
Wilbraham-Green Blower Co., Pottstown, Pa.

BOILERS (Gas)
Bryant Heater & Mfg. Co., The, Cleveland, Ohio, Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Gallaher Boiler Co., Laclede Gas Bldg., St. Louis, Mo.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Hugo Manufacturing Co., West Duluth, Minn.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Kidde & Co., 103 Park Ave., New York, N. Y.
National Machine Works, Sheffield & North Ave., Chicago, Ill.
Ofeldt Gas Fired Boiler Co., Inc., The, Nyack-on-the-Hudson, N. Y.
Wales Co., The, Kalamazoo, Mich.

BOILERS (Gas for House Heating)
American Radiator Co., New York, N. Y., Chicago, Ill.
Bryant Heater & Mfg. Co., The, Cleveland, Ohio, Chicago, Ill.
Gallaher Boiler Co., Laclede Gas Bldg., St. Louis, Mo.
Kidde & Co., 103 Park Ave., New York, N. Y.
Wales Co., The, Kalamazoo, Mich.

BOILERS (Waste Heat)
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co., The, Baltimore, Md.
U. G. I. Contracting Co., The, Broad and Arch Sts., Philadelphia, Pa.

BRAKE AND FRICTION MATERIALS
Johns-Manville Inc., Madison Ave. and 41st St., New York, N. Y.

BRAZING TABLES
American Gas Furnace Co., Elizabeth N. J.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Rathbone, Sard & Co., Albany, N. Y.

BRICK, FIREBRICK
Gas Machinery Co., Inc., The, Cleveland, Ohio
J. H. Gautier & Co., Jersey City, N. J.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Improved Equipment Co., The, 24 State St., New York, N. Y.
Missouri Fire Brick Co., St. Louis, Mo.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Russell Engineering Co., St. Louis, Mo.

BROILERS (Hotel)
American Stove Co., St. Louis, Mo.
Geo. M. Clark & Co., Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Fuller-Warren Co., The Milwaukee, Wiss.
Michigan Stove Co., The, Detroit, Mich.
Rathbone, Sard & Co., Albany, N. Y., Aurora, Ill.
Geo. D. Roper Corp., Rockford, Ill.

BURNERS (Industrial)
American Gas Appliance Co., 108 Lawrence St., Brooklyn, N. Y.
American Gas Furnace Co., Elizabeth, N. J.
Baltimore Gas Appliance & Mfg. Co., The, Baltimore, Md.

BURNERS (Industrial)—(Continued)
Century Stove & Mfg. Co., Johnstown, Pa.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Equitable Meter Co., Pittsburgh, Pa.
Fuller-Warren Co., The, Milwaukee, Wis.
Grinnell Co., Inc., Providence, R. I.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Hale Manufacturing Co., Chicago, Ill.
Charles A. Hones, Inc., Baldwin, Long Island, N. Y.
Hugo Manufacturing Co., West Duluth, Minn.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa.
C. M. Kemp Mfg. Co., The, Baltimore, Md.
Maxon Furnace & Engineering Co., The, Muncie, Ind.
Monarch Engineering & Mfg. Co., American Bldg., Baltimore, Md.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Needham Gas Appliance Co., The, Passaic, N. J.
Geo. D. Roper Corp., Rockford, Ill.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.
Tappan Stove Co., The, Mansfield, Ohio
A. H. Wolff Gas Radiator Co., The, 4 Great Jones St., New York, N. Y.

BURNERS (Lighting)
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
General Gas Light Co., New York, N. Y., Kalamazoo, Mich.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Lindsay Light Co., New York, N. Y., Chicago, Ill.
Welsbach Co., Gloucester, N. J.

BY-PRODUCT OVENS
Belgian American Coke Ovens Corp., St. Louis, Mo.
By-Products Coke Corp., Chicago, Ill.
Foundation Oven Corp., Woolworth Bldg., New York, N. Y.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Improved Equipment Co., The, 24 State St. New York, N. Y.
Koppers Co., The, Pittsburgh, Pa.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Semet-Solvay Co., Syracuse, N. Y.

BY-PRODUCT RECOVERY APPARATUS
Bartlett Hayward Co., The, Baltimore, Md.
Foundation Oven Corp., Woolworth Bldg., New York, N. Y.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Isbell-Porter Co., Newark, N. J.
Koppers Co., The, Pittsburgh, Pa.
Steere Engineering Co., Detroit, Mich.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

CALORIMETERS
American Meter Co., Inc., New York, N. Y.
Lambert Meter Co., Inc., Bush Terminal Bldg., Brooklyn, N. Y.
Maryland Meter Works, Baltimore, Md.
D. McDonald & Co., Albany, N. Y.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.
Superior Meter Co., Bush Terminal Bldg., Brooklyn, N. Y.

CASING, TUBING (Steel)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

CASTINGS (Brass, Grey Iron)
Banner Iron Works, 4560 Shaw Ave., St. Louis, Mo.
Bartlett Hayward Co., The, Baltimore, Md.
Cleveland Co-Operative Stove Co., The, Cleveland, Ohio
Howard Stove Co., Beaver Falls, Pa.
S. B. Sexton Stove & Mfg., The, Baltimore, Md.
Western Gas Construction Co., The, Fort Wayne, Ind.

CEMENT, HIGH TEMPERATURE
Johns-Manville, Inc., Madison Ave. & 41st St., New York, N. Y.
Missouri Fire Brick Co., St. Louis, Mo.
Quigley Furnace Specialties Co., 26 Cortlandt
Russell Engineering, St. Louis, Mo. St., New York, N. Y.

CHARGING COAL
Bartlett Hayward Co., The, Baltimore, Md.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Isbell-Porter Co., Newark, N. J.
Phillips, Lang & Co., Chicago, Ill.
Western Gas Construction Co., The, Fort Wayne, Ind.

CLOTHES DRYERS
Canton Clothes Dryer Co., The, Canton, Ohio.

CHIMNEYS (Radical Brick)
Alphons Custodis Chimney Construction Co., Marquette Bldg., Chicago, Ill.

COAL AND COKE (Conveyors, Crushers, Screeners)
Bartlett Hayward Co., The, Baltimore, Md.
R. H. Beaumont Co., 315 Arch St., Philadelphia, Pa.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Isbell-Porter Co., Newark, N. J.
Phillips, Lang & Co., Chicago, Ill.
Riter-Conley Company, Pittsburgh, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.

COAL TAR PRODUCTS & CHEMICALS
Barrett Company, The, 17 Battery Place, New York, N. Y.

COCKS (Ranges, Water Heaters, Service and Meter)
A-B Stove Co., Battle Creek, Mich.
Acme Brass Works, Detroit, Mich.
Aws Mfg. Co., The, 398 Harman St., Brooklyn, N. Y.
Claus Automatic Gas Cock Co., Milwaukee, Wis.
Detroit Brass & Malleable Works, Detroit, Mich.
Geo. D. Roper Corp., Rockford, Ill.
Hays Mfg. Co., Inc., Erie, Pa.
H. Mueller Mfg. Co., New York, N. Y., Decatur, Ill.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Kitson Co., 2837 Oakford St., Philadelphia, Pa.
McRae & Roberts Co., The, Detroit, Mich.
Peninsular Brass Works, Detroit, Mich.
Roberts Brass Mfg. Co., The, Detroit, Mich.
Standard Brass Works, Detroit, Mich.

COMPOUND FOR CLEANING GAS METERS AND GAS STOVES
Standard Chemical & Supply Co., Cambridge A, Mass.

COMPRESSORS
American Gas Construction Co., Newton, Ia.
C. M. Kemp Mfg. Co., The, Baltimore, Md.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Surface Combustion Co., The 366 Gerard Ave., Bronx, N. Y.

CONDENSERS
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co., The, Baltimore, Md.
Cruse-Kemper Co., Ambler, Pa.
M. T. Davidson Co., 154 Nassau St., New York, N. Y.
Davis & Farnum Mfg. Co., Waltham, Mass.
Gas Engineering Co. Ingram Ave., Trenton, N. J.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Isbell-Porter Co., Newark, N. J.
Riter-Conley Company, Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
Stacey Bros. Gas Construction Co., The, Cincinnati, Ohio
Stacey Manufacturing Co., The, Cincinnati, Ohio.

Steere Engineering Co., Detroit, Mich.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

COOKING AUXILIARIES
G. S. Blodgett Co., The, Burlington, Vt.
Commercial Gas Appliance Co., Philadelphia, Pa.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Duparquet, Huot & Moneuse Co., 108 W. 22nd St., New York, N. Y.
Fuller-Warren Co. The, Milwaukee, Wis.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Geo. D. Roper Corp., Rockford, Ill.
Scott Gas Appliance Co., Bond Bldg., Washington, D. C.

COUPLINGS
S. R. Dresser Mfg. Co., Bradford, Pa.

COVERINGS (Cold Pipe, Steam Pipe, Tank and Boiler)
Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Johns-Manville Inc., Madison Ave. and 41st St., New York, N. Y.

CYLINDERS (Pressure)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

DECALCOMANIA PRODUCTS
Meyercord Co., Inc., The, Chamber of Commerce Bldg., Chicago, Ill.

ELECTRIC CONTROLLING DEVICES
Cutler-Hammer Mfg. Co., The, Milwaukee, Wis., New York, N. Y.

ELEVATORS
Craig Ridgway & Son Co., Coatesville, Pa.
Phillips, Lang & Co., Chicago, Ill.

EXCHANGES (Heat)
Bartlett Hayward Co., The, Baltimore, Md.
Riter-Conley Co., Pittsburgh, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

EXPERT APPRAISAL
Steere Engineering Co., Detroit, Mich.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.

EXTRACTORS (Tar, Dust, Fumes)
Bartlett Hayward Co., The, Baltimore, Md.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Isbell-Porter Co., Newark, N. J.
Russell Engineering Co., St. Louis, Mo.
Steere Engineering Co., Detroit, Mich.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

FITTINGS
A-B Stove Co., Battle Creek, Mich.
Acme Brass Works, Detroit, Mich.
Aws Manufacturing Co., New York, N. Y.
Bartlett Hayward Co., The, Baltimore, Md.
Banner Iron Works, 4560 Shaw Ave., St. Louis, Mo.
Claus Automatic Gas Cock Co., Milwaukee, Wis.
Davis & Farnum Mfg. Co., Waltham, Mass.
Detroit Brass & Malleable Works, Detroit, Mich.
S. R. Dresser Mfg. Co., Bradford, Pa.
Eries Stove & Mfg. Co., Erie, Pa.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Grinnell Co., Inc., Providence, R. I.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Kitson Co., 2827 Oakford St., Philadelphia, Pa.
McRae & Roberts Co., The, Detroit, Mich.
H. Mueller Mfg. Co., New York, N. Y., Decatur, Ill.
Peninsular Brass Works, Detroit, Mich.
Roberts Brass Mfg. Co., The, Detroit, Mich.
Geo. D. Roper Corp., Rockford, Ill.
Standard Brass Works, Detroit, Mich.
Steere Engineering Co., Detroit, Mich.
Welsbach Co., Gloucester, N. J.
Western Gas Construction Co., The, Fort Wayne, Ind.

FITTINGS (Malleable Iron)
Crane Co., Chicago, Ill.
Detroit Brass & Malleable Works, Detroit, Mich.
Geo. D. Roper Corp., Rockford, Ill.

FLASHLIGHTS AND BATTERIES
French Battery & Carbon Co., Madison, Wis.

FLEXIBLE TUBING AND ENDS
Atlantic Tubing Co., Providence, R. I.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.

FORGES
American Gas Furnace Co., Elizabeth, N. J.
B. F. Sturtevant Co., Inc., Boston, Mass.

FUEL BRIQUETTING
Foundation Oven Corp., Woolworth Bldg., New York, N. Y.

FUEL ECONOMIZERS
B. F. Sturtevant Co., Inc., Boston, Mass.

FURNACES
American Gas Furnace Co., Elizabeth, N. J.
Century Stove & Mfg. Co., Johnstown, Pa.
Eries Stove & Mfg. Co., Erie, Pa.
Charles A. Hones, Inc., Baldwin, Long Island, N. Y.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Maxon Furnace and Engineering Co., Muncie, Ind.
Monarch Engineering & Mfg. Co., American Bldg., Baltimore, Md.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Needham Gas Appliance Co., The, Passaic, N. J.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Russell Engineering Co., St. Louis, Mo.
S. B. Sexton Stove & Mfg. Co., The, Baltimore, Md.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.

FUSES
Johns-Manville Inc., Madison Ave. and 41st St., New York, N. Y.

GAS COAL PRODUCERS
Amherst Fuel Co., Cincinnati, O.
Creech Coal Co., 733 Union Trust Bldg., Cincinnati, Ohio.
Harlan Co-operative Coal Co., Lexington, Ky.

GAS ENGINES
Bartlett Hayward Co., The, Baltimore, Md.
B. F. Sturtevant Co., Inc., Boston, Mass.

GAS ENGINE COCKS AND VALVES
Standard Brass Works, Detroit, Mich.

GAS IRONS
A-B Stove Co., Battle Creek, Mich.
Benson Mfg. Co., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Strause Gas Iron Co., Philadelphia, Pa.

GAS LEAK INDICATORS
Taylor Instrument Companies, Rochester, N. Y.

GAS LOGS
Strait & Richards, Inc., Newark, N. J.

GAS MAIN BAGS AND GAS MAIN STOPPERS
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Safety Gas Main Stopper Co., 523 Atlantic Ave., Brooklyn, N. Y.

GAS MIXERS
American Gas Furnace Co., Elizabeth, N. J.
Century Stove & Mfg. Co., Johnstown, Pa.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Brass & Malleable Works, Detroit, Mich.
Eriez Stove & Mfg. Co., Erie, Pa.
Fuller-Warren Co., The, Milwaukee, Wis.
Grinnell Co., Inc., Providence, R. I.
Hale Manufacturing Co., Chicago, Ill.
Hays Manufacturing Co., Inc., Erie, Pa.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa.
C. M. Kemp Mfg. Co., The, Baltimore, Md.
Maxon Furnace & Engineering Co., Muncie, Ind.
Monarch Engineering & Mfg. Co., American Bldg., Baltimore, Md.
Geo. D. Roper Corp., Rockford, Ill.
Strait & Richards, Inc. Newark, N. J.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.

GAS PLANTS (Blue)
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co., The, Baltimore, Md.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Improved Equipment Co., The, 24 State St., New York, N. Y.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

GAS PLANTS (OIL)
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co., The, Baltimore, Md.

GAS PLANTS (Carburetted Water)
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co., The, Baltimore, Md.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Improved Equipment Co., The, 24 State St., New York, N. Y.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Stacey Manufacturing Co., The, Cincinnati, Ohio
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

GAS PLANTS (Coal) (Engineers)
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co., The, Baltimore, Md.
Davis & Farnum Mfg. Co., Waltham, Mass.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Improved Equipment Co., The, 24 State St., New York, N. Y.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Isbell-Porter Co., Newark, N. J.
Missouri Fire Brick Co., St. Louis, Mo.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Riter-Conley Company, Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
Semet-Solvay Co., Syracuse, N. Y.
Stacey Manufacturing Co., The, Cincinnati, Ohio
Stacey Bros. Gas Construction Co., The, Cincinnati, Ohio
Steere Engineering Co., Detroit, Mich.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

GAS RANGE WATER HEATERS
Elliott Water Heater Co., Inc., 1246 Myrtle Ave., Brooklyn, N. Y.
Geo. D. Roper Corp., Rockford, Ill.

GOVERNORS, PRESSURE VACUUM & PUMP
American Gas Construction Co., Newton, Ia.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.

HEATERS (Room)
American Stove Co., St. Louis Mo.
Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
Century Stove & Mfg. Co., Johnstown, Pa.
Geo. M. Clark & Co., Div. Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co., Rockford, Ill.
Eriez Stove & Mfg. Co., Erie, Pa.
Estate Stove Co., Hamilton, Ohio
General Gas Light Co., New York, N. Y., Kalamazoo, Mich.
Grinnell Co., Inc., Providence, R. I.
J. H. Grayson Mfg. Co., The, Athens, Ohio
Hugo Manufacturing Co., West Duluth, Minn.
Illinois Specialty Mfg. Co., Bloomington, Ill.
Kidde & Co., 103 Park Ave., New York, N. Y.
Kennedy-Toombs, Inc., 12 Eleventh Ave., New York, N. Y.
Lawson Mfg. Co., Pittsburgh, Pa.
New Process Stove Co., Div., Cleveland, Ohio
Ohio State Stove & Mfg. Co., The, Columbus, Ohio
Reliable Stove Co. Div., Cleveland, Ohio
Reznor Mfg. Co., Mercer, Pa.
Roberts & Mander Stove Co., Philadelphia, Pa.
Sanitary Heating Co., The, 233-37th St., Brooklyn, N. Y.
J. B. Slattery & Bro. Inc., 108-110 Lawrence St., Brooklyn, N. Y.
Strait & Richards, Inc., Newark, N. J.
B. F. Sturtevant Co., Inc., Boston, Mass.
Van Zandt Gas Appliance Co. St. Louis, Mo.
Welsbach Co., Gloucester, N. J.
Western Gas Construction Co., The, Fort Wayne, Ind.
Wheeling Corrugating Co., Wheeling, W. Va.
A. H. Wolff Gas Radiator Co., The, 4 Great Jones St., New York, N. Y.

HEATERS (Garage)
Gallaher Boiler Co., Laclede Gas Bldg., St. Louis, Mo.
Howard Stove Co., Beaver Falls, Pa.
Kidde & Co., 103 Park Ave., New York, N. Y.
B. F. Sturtevant Co., Inc., Boston, Mass.
Wales Co., The, Kalamazoo, Mich.

HEATERS (Pressing and Soldering Irons)
American Gas Furnace Co., Elizabeth, N. J.
Amercian Stove Co., St. Louis, Mo.
Bryant Heater & Mfg. Co., The, Cleveland, Ohio, Chicago, Ill.
Geo M. Clark & Co. Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eclipse Gas Stove Co., Rockford, Ill.
Estate Stove Co., Hamilton, Ohio
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Charles A. Hones, Inc., Baldwin, Long Island, N. Y.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Johnson Gas Appliance Co., Ceder Rapids, Iowa
Strait & Richards, Inc., Newark, N. J.

HIGH PRESSURE SYSTEMS
American Gas Construction Co., Newton, Ia.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Grinnell Co., Inc., Providence, R. I.
C. M. Kemp Mfg. Co., The, Baltimore, Md.
H. Mueller Mfg. Co., New York N. Y., Decatur, Ill.
Needham Gas Appliance Co., The, 1 S. Lafayette St., New York, N. Y.
Selas Co., Philadelphia, Pa.
Surface Combustion Co., The, 366 Gerard Ave. Bronx, N. Y.

HOLDERS (Structural Steel Works)
American Gas Construction Co., Newton, Ia.
Banner Iron Works, 4560 Shaw Ave., St. Louis Mo.

Bartlett Hayward Co., The, Baltimore, Md.
Cruse-Kemper Co., Ambler, Pa.
Davis & Farnum Mfg. Co., Waltham, Mass.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Riter-Conley Company, Pittsburgh, Pa.
Stacey Bros. Gas Construction Co., The, Cincinnati, Ohio
Stacey Manufacturing Co., The, Cincinnati, Ohio
Western Gas Construction Co., The, Fort Wayne, Ind.

HOT PLATES
American Stove Co., St. Louis, Mo.
A-B Stove Co., Battle Creek, Mich.
Baltimore Gas Appliance & Mfg. Co., The, Baltimore, Md.
Century Stove & Mfg. Co., Johnstown, Pa.
Geo. M. Clark & Co. Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co., Rockford, Ill.
Elgin Stove & Oven Co., Elgin, Ill.
Eriez Stove & Mfg. Co., Erie, Pa.
Fuller-Warren Co., The, Milwaukee, Wis.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Howard Stove Co., Beaver Falls, Pa.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Michigan Stove Co., The, Detroit, Mich.
Ohio State Stove & Mfg. Co., The, Columbus, Ohio
Rathbone, Sard & Co., Albany, N. Y., Aurora, Ill.
J. B. Slattery & Bro., Inc., 108-110 Lawrence St., Brooklyn, N. Y.
Tappan Stove Co., The, Mansfield, Ohio
Union Stove Works, 20 Beekman St., New York, N. Y.
Weir Stove Co., Taunton, Mass.
Wheeling Corrugating Co., Wheeling, W. Va.
A. H. Wolff Gas Radiator Co., The, 4 Great Jones St., New York, N. Y.

INDUSTRIAL FLOORING
Johns-Manville Inc., Madison Ave. and 41st St., New York, N. Y.

IRONING MACHINES
American Ironing Machine Co., 168 N. Michigan Ave., Chicago, Ill.

INCINERATORS
Estate Stove Co., Hamilton, Ohio
Odorless Incinerator Co., Philadelphia, Pa.
Ruud Mfg. Co., Pittsburgh, Pa.

INSTRUMENTS (Measuring, Testing and Recording)
American Meter Co., Inc., New York, N. Y.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., The, Waterbury, Conn.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Equitable Meter Co., Pittsburgh, Pa.
Foxboro Co., Inc., The, Foxboro, Mass.
Lambert Meter Co., Inc., Bush Terminal Bldg., Brooklyn, N. Y.
Maryland Meter Works, Baltimore, Md.
D. McDonald & Co., Albany, N. Y.
Precision Instrument Co., 21 Halsey St., Newark, N. J.
Republic Flow Meters Co., 2240 Diversey Blvd., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., The, Brooklyn, N. Y.
Steere Engineering Co., Detroit, Mich.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

INSULATING MATERIALS
American Lava Corp., Chatanooga, Tenn.
Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Celite Products Co., 11 Broadway, New York, N. Y.
Davis & Farnum Mfg. Co., Waltham, Mass.
Johns-Manville Inc., Madison Ave. and 41st St., New York, N. Y.
Quigley Furnace Specialties Co., 26 Cortlandt St., New York, N. Y.

KILNS (For Firing Glass, China and Pottery)
B. F. Drakenfeld & Co., Inc., 50 Murray St., New York, N. Y.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Russell Engineering Co., St. Louis, Mo.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.

KILNS
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Russell Engineering Co., St. Louis, Mo.
B. F. Sturtevant Co., Inc., Boston, Mass.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.

LABORATORY (Flash and Fire Test Apparatus)
Taylor Instrument Companies, Rochester, N. Y.

LIGHTERS (Ranges)
Claus Automatic Gas Cock Co., Milwaukee, Wis.
Michigan Stove Co., The Detroit, Mich.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Geo. D. Roper Corp., Rockford, Ill.
Safety Gas Lighter Co., Lynn, Mass.
J. M. Sherwood Co., New York, N. Y.
Strause Gas Iron Co., Philadelphia, Pa.
Welsbach Co., Gloucester, N. J.

LIGHTING (Fixtures)
Salem Brothers, 122 Centre St., New York, N. Y.
Welsbach Co., Gloucester, N. J.

LIGHTING (Gas Domes, Portables, etc.)
Kramer Bros. Lamp Co., 585 Broadway, New York, N. Y.
Royal Art Glass Co., 243 Canal St., New York, N. Y.
Salem Brothers, 122 Centre St., New York, N. Y.
Welsbach Co., Gloucester, N. J.

LIGHTING (Glassware)
Salem Brothers, 122 Centre St., New York, N. Y.
Welsbach Co., Gloucester, N. J.

LIGHTING (Incidentals)
Storrs Mica Co., Owego, N. Y.

LIGHTING (Mantles)
General Gas Light Co., New York, N. Y., Kalamazoo, Mich.
Lindsay Light Co., New York, N. Y., Chicago, Ill.
Welsbach Co., Gloucester, N. J.

LUX MATERIAL
Alpha-Lux Co., Inc., 192 Front St., New York, N. Y.

METAL RECEPTACLES
American Gas Furnace Co., Elizabeth, N. J.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Charles A. Hones, Inc., Baldwin, Long Island, N. Y.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.
United Lead Co., 111 Broadway, New York, N. Y.

METERS
American Meter Co., Inc., New York, N. Y.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, Ohio
Cleveland Gas Meter Co., Cleveland, Ohio
Connersville Blower Co., The, Connersville, Ind., New York, N. Y.
Cutler-Hammer Mfg. Co., The, Milwaukee, Wis., New York, N. Y.
Equitable Meter Co., Pittsburgh, Pa.
Foxboro Co., Inc., The, Foxboro, Mass.
John J. Griffin & Co., 1513 Race St., Philadelphia, Pa.
Helme & McIlhenny, 17th and Clearfield Sts., Philadelphia, Pa.
Lambert Meter Co., Inc., Bush Terminal Bldg., Brooklyn, N. Y.
D. McDonald & Co., Albany, N. Y.
Maryland Meter Works, Baltimore, Md.
Metric Metal Works, Erie, Pa.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.
Pittsburgh Meter Co., East Pittsburgh, Pa.
Precision Instrument Co., 21 Halsey St., Newark, N. J.
Republic Flow Meters Co., 2240 Diversey Blvd., Chicago, Ill.
Rotary Meter Co., 52 Vanderbilt Ave., New York, N. Y.
Sprague Meter Co., The, Bridgeport, Conn.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

METERS (Air and Steam)
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Pittsburgh Meter Co., East Pittsburgh, Pa.
Republic Flow Meters Co., 2240 Diversey Blvd., Chicago, Ill.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.

METER CONNECTIONS, SEALS, Etc.
American Meter Co., Inc., New York, N. Y.
Cleveland Gas Meter Co., Cleveland, Ohio
S. R. Dresser Mfg. Co., Bradford, Pa.
Equitable Meter Co., Pittsburgh, Pa.
Helme & McIlhenny, 17th and Clearfield Sts., Philadelphia, Pa.
Lattimer Stevens Co., The, Columbus, Ohio
D. McDonald & Co., Albany, N. Y.
H. Mueller Mfg. Co., New York, N. Y., Decatur, Ill.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.
Pittsburgh Meter Co., East Pittsburgh, Pa.
Sprague Meter Co., The, Bridgeport, Conn.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.

METERS (Steam, Condensation, Gasoline, Oil, Hot and Cold Water)
Pittsburgh Meter Co., East Pittsburgh, Pa.
Republic Flow Meters Co., 2240 Diversey Blvd., Chicago, Ill.

METER PROVERS
American Meter Co., Inc., New York N. Y.
Equitable Meter Co., Pittsburgh, Pa.
John J. Griffin & Co., Philadelphia, Pa.
Helme & McIlhenny, 17th and Clearfield Sts., Philadelphia, Pa.
Lambert Meter Co., Inc., Bush Terminal Bldg., Brooklyn, N. Y.
Maryland Meter Works, Baltimore, Md.
D. McDonald & Co., Albany, N. Y.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.
Pittsburgh Meter Co., East Pittsburgh, Pa.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.

METER SEALS AND ADJUSTABLE CONNECTIONS
Lattimer-Stevens Co., The, Columbus, O.

METER SHELF
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Lattimer-Stevens Co., The, Columbus, O.

OFFICE LABOR SAVING DEVICES
Addressograph Co., Chicago, Ill.
Elliott-Fisher Co., Harrisburg, Pa.
Kalamazoo Loose-Leaf Binder Co., Kalamazoo, Mich.
Library Bureau, Boston, Mass.
Remington Typewriter Co., 374 Broadway, New York, N. Y.
Underwood Typewriter Co., 30 Vesey St., New York, N. Y.

OIL (Diaphragm)
John J. Griffin & Co., 1513 Race St., Philadelphia, Pa.
Superior Meter Co., Bush Terminal Bldg., Brooklyn, N. Y.

OVENS (Baking and Cooking)
G. S. Blodgett Co., The, Burlington, Vt.
Geo. M. Clark & Co. Div., Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York N. Y.
Crandall-Pettee Co., The, 150 Franklin St., New York, N. Y.
Eclipse Gas Stove Co., Rockford, Ill.
Elgin Stove & Oven Co., Elgin, Ill.
Fuller-Warren Co., The, Milwaukee, Wis.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Grinnell Co., Inc., Providence, R. I.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Meek Oven Mfg. Co., 18 W. 34th St., New York, N. Y.
Ohio State Stove & Mfg. Co., The, Columbus, Ohio.
E. E. Steiner & Co., Inc., 20 Orange St., Newark, N. J.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.
Union Steel Products Co., Ltd., The, Albion Mich.
Wheeling Corrugating Co., Wheeling, W. Va.

OVENS (Annealing, Japanning, Drying, Core, etc.)
American Gas Furnace Co. Elizabeth, N. J.
Elgin Stove & Oven Co., Elgin, Ill.
Gehnrich Indirect Heat Oven Co., Inc., Long Island City, N. Y.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Grinnell Co., Inc. Providence, R. I.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Johnson Gas Appliance Co., Cedar Rapids, Iowa
C. M. Kemp Mfg. Co., The, Baltimore, Md.
Meek Oven Mfg. Co., 18 W. 34th St., New York, N. Y.
Monarch Engineering & Mfg. Co., American Bldg., Baltimore, Md.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
E. E. Steiner & Co., Inc., 20 Orange St., Newark, N. J.
Surface Combustion Co., The, 366 Gerard Ave., Bronx, N. Y.
Union Steel Products Co., The, Ltd., Albion, Mich.
Wheeling Corrugating Co., Wheeling, W. Va.
Young Bros. Co., Detroit, Mich.

OVENS (Warming)
G. S. Blodgett Co., The, Burlington, Vt.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eclipse Gas Stove Co., Rockford, Ill.
Elgin Stove & Oven Co., Elgin, Ill.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Meek Oven Mfg. Co., 18 W. 34th St., New York, N. Y.
Union Steel Products, Co., Ltd., The, Albion, Mich.
Wheeling Corrugating Co., Wheeling, W. Va.

PACKINGS (Rods, Plunger, Piston and Flange)
Johns-Manville, Inc., Madison Ave., and 41st St., New York, N. Y.

PAINT (Outside Steel Work)
Johns-Manville, Inc., Madison Ave. & 41st St., New York, N. Y.

PHOTOMETERS
American Meter Co., Inc., New York, N. Y.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Maryland Meter Works, Baltimore, Md.
D. McDonald & Co., Albany, N. Y.
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.

PIPE
Bartlett Hayward Co. The, Baltimore, Md.
Davis & Farnum Mfg. Co., Waltham, Mass.
Grinnell Co., Inc., Providence, R. I.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Riter-Conley Co., Pittsburg, Pa.
Steere Engineering Co., Detroit, Mich.
United Lead Co., 111 Broadway, New York, N. Y.

PIPE CASTINGS AND SPECIALS
Banner Iron Works, 4560 Shaw Ave., St. Louis, Mo.
Bartlett Hayward Co. The, Baltimore, Md.
Davis & Farnum Mfg. Co., Waltham, Mass.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Isbell-Porter Co. Newark, N. J.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Stacey Manufacturing Co., The, Cincinnati, Ohio
Steere Engineering Co., Detroit, Mich.
Western Gas Construction Co., The, Fort Wayne, Ind.

PIPE CLAMPS AND SLEEVES
Davis & Farnum Mfg. Co., Waltham, Mass.
S. R. Dresser Mfg. Co., Bradford, Pa.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Steere Engineering Co., Detroit, Mich.

PIPE PACKING
Celite Products Co., 11 Broadway New York, N. Y.
Grinnell Co., Inc., Providence, R. I.
Johns-Manville, Inc., Madison Ave. & 41st St., New York, N. Y.
United Lead Co., 111 Broadway, New York, N. Y.

PIPE TOOLS (Caulking, Cutting, Tapping)
Grinnell Co., Inc., Providence, R. I.
H. Mueller Mfg. Co., New York, N. Y., Decatur, Ill.
Safety Gas Main Stopper Co., 943 Fulton St., Brooklyn, N. Y.
United Lead Co., 111 Broadway, New York, N. Y.

PLATE WARMERS
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Duparquet, Huot & Moneuse Co., 108 W. 22d St., New York, N. Y.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn N. Y.
Geo. D. Roper Corp., Rockford, Ill.

PORCELAIN ENAMEL PARTS (Stoves, Lamps, Linings, Stamping and Spinnings)
Baltimore Enamel & Novelty Co., Baltimore, Md.
Chicago Vitreous Enamel Product Co., 1407 So. 55th Court, Cicero, Ill.
Eclipse Gas Stove Co., Rockford, Ill.
Enamel Products Co., The, Cleveland, Ohio
Porcelain Enamel & Mfg. Co., The, Baltimore, Md.
Union Steel Products Co. Ltd., The, Albion, Mich.

PORCELAIN ENAMEL PLANTS (Installers)
Porcelain Enamel & Mfg. Co., The, Baltimore, Md.

PRESSURE GAUGES
American Meter Co., Inc., New York, N. Y.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bryant Heater & Mfg. Co., The, Cleveland, Ohio
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Equitable Meter Co., Pittsburgh, Pa.
Foxboro Co., Inc., The, Foxboro, Mass.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Grinnell Co., Inc., Providence, R. I.
Maryland Meter Works, Baltimore, Md.
D. McDonald Co., Albany, N. Y.
Nathaniel Tufts Meter Works, 455 Connecticut St., Boston, Mass.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., The, Brooklyn, N. Y.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
Taylor Instrument Cos., Rochester, N. Y.
Western Gas Construction Co., The, Fort Wayne, Ind.

PRESSURE GAUGES (Boiler, Naphtha, Oil, Steam Tar)
M. T. Davidson Co., 154 Nassau St., New York, N. Y.

PUMPS
American Gas Construction Co., Newton, Ia.
Connersville Blower Co., The, Connersville, Ind.
M. T. Davidson Co., 154 Nassau St., New York, N. Y.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Nathaniel Tufts Meter Works, 455 Commercial St., Boston, Mass.
Geo. D. Roper Corp., Rockford, Ill.
Superior Meter Co., Bush Terminal, Brooklyn, N. Y.
Western Gas Construction Co., The, Fort Wayne, Ind.

PURIFIERS
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co. The, Baltimore, Md.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Cruse-Kemper Co., Ambler, Pa.
Davis & Farnum Mfg. Co., Waltham, Mass.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Gas Machinery Co., Cleveland, Ohio
Improved Equipment Co., The, 24 State St., New York, N. Y.
Isbell-Porter Co. Newark, N. J.
Riter-Conley Co., Pittsburg, Pa.
Russell Engineering Co., St. Louis, Mo.
Stacey Bros. Gas Construction Co., The, Cincinnati, Ohio
Stacey Manufacturing Co., The, Cincinnati, Ohio
Steere Engineering Co., Detroit, Mich.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

PURIFIER BOX PACKING
John-Manville, Inc., Madison Ave. & 41st St., New York, N. Y.

PURIFYING MATERIALS
Alpha-Lux Co., Inc., 192 Front St., New York, N. Y.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Gas Purifying Materials Co., Long Island City, N. Y.
J. F. Henderson Co., 1707 Commonwealth Bldg., Pittsburgh, Pa.
Iron Hydroxide Co., Paschall Station, Philadelphia, Pa.
Iron Oxide Products, Inc., 1301 S. 55th Court, Cicero, Ill.
Eph Lyon, Trust Company Bldg., Franklin, Pa.

PYROMETERS (Indicating and recording)
Foxboro Co., Inc., The, Foxboro, Mass.
Taylor Instrument Cos., Rochester, N. Y.

RADIANT HEATERS
General Gas Light Co., New York, N. Y., Kalamazoo, Mich.
J. H. Grayson Mfg. Co., The, Athens, Ohio
Kennedy-Toombs, Inc., 126 Eleventh Ave., New York, N. Y.
Roberts andMander Stove Co., Philadelphia, Pa.
Welsbach Co., Gloucester, N. J.

RADIANTS AND BACK WALLS
Gem Clay Forming Co., The, Sebring, O.

RADIATORS
American Gas Appliance Co., 108 Lawrence St., Brooklyn, N. Y.
James B. Clow & Sons, Chicago, Ill.
Wm. M. Crane Co., 16 W. 32d St., New York, N. Y.
Eriez Stove & Mfg. Co., Erie, Pa.
Grinnell Co., Inc., Providence, R. I.
Hugo Manufacturing Co., West Duluth, Minn.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Kidde & Co., 103 Park Ave., New York, N. Y.
J. B. Slattery & Bro., Inc., 108-110 Lawrence St., Brooklyn, N. Y.
Williams Radiator Co., St. Louis, Mo.
A. H. Wolff Gas Radiator Co., The, 4 Great Jones St., New York, N. Y.

RANGES (Domestic)
A-B Stove Co., Battle Creek, Mich.
American Range & Foundry Co., Minneapolis, Minn.
American Stove Co., St. Louis, Mo.
Baltimore Gas Appliance & Mfg. Co., The, Baltimore, Md.
Bartlett & Co., Inc., Philadelphia, Pa.
Brunner Stove Co., 438 W. 164th St., New York City.
Century Stove & Mfg. Co., Johnstown, Pa.
Chambers Manufacturing Co., Shelbyville, Ind.
Geo. M. Clark & Co., Chicago, Ill.
Cleveland Co-Operative Stove Co., The Cleveland, Ohio
Comstock-Castle Stove Co., Quincy, Ill.
Abram Cox Stove Co., Philadelphia, Pa.
Wm. M. Crane Co., 16 W. 32nd St., New York, N. Y.
Cribben & Sexton Co., Chicago, Ill.
Crown Stove Works, Chicago, Ill.
Dangler Stove Co. Div., Cleveland, O.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co. Div., Rockford, Ill.
Eriez Stove & Mfg. Co., Erie, Pa.
Estate Stove Co., The, Hamilton, O.
Fuller-Warren Co., The, Milwaukee, Wis.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Home Stove & Foundry Co. Chicago, Ill.
Howard Stove Co., Beaver Falls, Pa.
Malleable Iron Range Co., Beaver Dam, Wis.
Michigan Stove Co., The, Detroit, Mich.
National Stove Co. Div., Lorain, O.
New Process Stove Co. Div., Cleveland, O.
Ohio State Stove & Mfg. Co., Columbus, O.
Peerless Mfg. Co., The, Louisville, Ky.
Peninsular Stove Co., The, Detroit, Mich.
Philadelphia Stove Co., Philadelphia, Pa.
Phillips & Clark Stove Co., Inc., Geneva, N. Y.
Quick Meal Stove Co. Div., St. Louis, Mo.
Rathbone, Sard & Co., Albany, N. Y., Aurora, Ill.
Reliable Stove Co. Div., Cleveland, O.
Roberts & Mander Stove Co., Philadelphia, Pa.
Scott Gas Appliance Co. Inc., Bond Bldg., Washington, D. C.
Security Stove & Mfg. Co., Kansas City, Mo.
S. B. Sexton Stove & Mfg. Co., The, Baltimore Md.
J. M. Sherwood Co., 154 Chambers St., New York, N. Y.
Tappan Stove Co., The, Mansfield, Ohio.
Trenkamp Stove & Mfg. Co., The, Cleveland, O.
Union Stove Works, 70 Beekman St., New York, N. Y.
Vesta Gas Range & Mfg. Co., Chattanooga, Tenn.
Walker & Pratt Mfg. Co., Boston, Mass.
Weir Stove Co., Taunton, Mass.
Wheeling Corrugating Co., Wheeling, W. Va.
Wincroft Stove Works, Middletown, Pa.
A. H. Wolff Gas Radiator Co., The, New York, N. Y.

RANGES (Hotel)
American Stove Co., St. Louis, Mo.
Baltimore Gas Appliance & Mfg. Co., The, Baltimore, Md.
Geo. M. Clark & Co. Div., Chicago, Ill.
Comstock-Castle Stove Co., Quincy, Ill.
Abram Cox Stove Co., Philadelphia, Pa.
Wm. M. Crane Co., 16 W. 32nd St., New York, N. Y.
Detroit Stove Works, Detroit, Mich.
Duparquet, Huot & Moneuse Co., 108 W. 22nd St., New York, N. Y.
Eclipse Gas Stove Co. Div, Rockford, Ill.
Estate Stove Co., The, Hamilton, O.
Fuller-Warren Co., The, Milwaukee, Wis.
General Gas Appliance Co., 103 Park Ave., New York, N. Y.
Michigan Stove Co., The, Detroit, Mich.
Roberts & Mander Stove Co., Philadelphia, Pa.
S. B. Sexton Stove & Mfg. Co., The, Baltimore, Md.

REFRACTORY MATERIALS
J. H. Gautier & Co., Jersey City, N. J.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Improved Equipment Co., The, 24 State St., New York, N. Y.
Johns-Manville Inc., Madison Ave & 41st St., New York, N. Y.
Missouri Fire Brick Co., St. Louis, Mo.
Monarch Engineering & Mfg. Co., American Bldg., Baltimore, Md.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Quigley Furnace Specialties Co., 26 Cortlandt St., New York, N. Y.
Riter-Conley Co., Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
G. F. Schmidt, Chicago, Ill.
United States Refractories Corp., Mount Union, Pa.

REGULATORS (Governors)
American Gas Construction Co., Newton, Ia.
Chaplin-Fulton Mfg. Co., The, Pittsburgh, Pa.
Connelly Iron Sponge & Governor Co., 227 Fulton St., New York, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Equitable Meter Co., Pittsburgh, Pa.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Improved Equipment Co., The, 24 State St., New York, N. Y.
Isbell-Porter Co., Newark, N. J.
H. Mueller Mfg. Co., New York, N. Y., Decatur, Ill.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Reynolds Gas Regulator Co., Anderson, Ind.
Sprague Meter Co., The, Bridgeport, Conn.
Steere Engineering Co., Detroit, Mich.
Western Gas Construction Co., The, Fort Wayne, Ind.

REPAIRS (Gas Meters and Appliances)
Helme & McIlhenny, 17th and Clearfield Sts., Philadelphia, Pa.
Maryland Meter Works, Baltimore, Md.
Superior Meter Co., Bush Terminal Bldg., Brooklyn, N. Y.
Western Gas Construction Co., The, Fort Wayne, Ind.

RETORTS
Gas Machinery Co., Inc., The, Cleveland, Ohio
J. H. Gautier & Co., Jersey City, N. J.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Improved Equipment Co., The, 24 State St., New York, N. Y.
Missouri Fire Brick Co., St. Louis, Mo.
Parker-Russell Mining & Mfg. Co., The, St. Louis, Mo.
Riter-Conley Co., Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
West Gas Improvement Co. of America, 150 Nassau St., New York, N. Y.

ROOFING
Johns-Manville, Inc., Madison Ave., and 41st St., New York, N. Y.

ROOF CEMENTS
Johns-Manville, Inc., Madison Ave. and 41st St., New York, N. Y.

RUST PREVENTIVE
Superior Laboratories, Grand Rapids, Mich.

SAFETY DEVICES (Gas Masks, Oxygen Breathing Apparatus, etc.)
Mine Safety Appliances Co., Pittsburgh, Pa.

SCRUBBERS
American Gas Construction Co., Newton, Ia.
Bartlett Hayward Co., The, Baltimore, Md.
Davis & Farnum Mfg. Co., Waltham, Mass.
Foundation Oven Corp., Woolworth Bldg., New York, N. Y.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Improved Equipment Co., The, 24 State St., New York, N. Y.
Isbell-Porter Co., Newark, N. J.
Koppers Co., The, Pittsburgh, Pa.
National Machine Works, Sheffield & North Aves., Chicago, Ill.
Riter-Conley Co., Pittsburgh, Pa.
Russell Engineering Co., St. Louis, Mo.
Stacey Bros. Gas Construction Co., The, Cincinnati, O.
Stacey Manufacturing Co., The, Cincinnati, O.
Steere Engineering Co., Detroit, Mich.
U. G. I. Contracting Co., The, Broad & Arch Sts., Philadelphia, Pa.
Western Gas Construction Co., The, Fort Wayne, Ind.

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Kidde & Co., 103 Park Ave., New York, N. Y.

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Grinnell Co., Inc., Providence, R. I.
Hays Mfg. Co., Inc., Erie, Pa.
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Ludlow Valve Mfg. Co., The, Ft. Adams St., Troy, N. Y.

SPECIALS—CAST IRON
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STOVES (Confectioners, Laundry, Tailor)
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A-B Stove Co., Battle Creek, Mich.
Geo. M. Clark & Co. Div., Chicago, Ill.
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Elgin Stove & Oven Co., Elgin, Ill.
Fuller-Warren Co., The, Milwaukee, Wis.
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Geo. D. Roper, Corp., Rockford, Ill.

STRUCTURAL STEEL WORKS (See Holders)

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Gas Machinery Co., Inc., The, Cleveland, Ohio.
Improved Appliance Co., The, 419 Kent Ave., Brooklyn, N. Y.
Metcalfe-Shaw Corp., 1304 Flatbush Ave., Brooklyn, N. Y.
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Stacey Manufacturing Co., The, Cincinnati, O.
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TAR DEHYDRATION
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Elgin Stove & Oven Co., Elgin, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Gas Engineering Co., Ingram Ave., Trenton, N. J.
Gas Machinery Co., Inc., The, Cleveland, Ohio
Grinnell Co., Inc., Providence, R. I.
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Gas Machinery Co., Inc., The, Cleveland, Ohio
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B. Ryan & Co., 372 W. 15th St., New York, N. Y.
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H. A. Wilson Co., The, 97 Chestnut St., Newark, N. J.

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THORIUM
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Peninsular Brass Works, Detroit, Mich.
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WATER STILLS (Gas Heated)
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Young Bros. Co., Detroit, Mich.

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Bartlett Hayward Co., The, Baltimore, Md.
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WELDING
American Gas Furnace Co., Elizabeth, N. J.
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WALLACE, R. S., Peoria, Ill. (Illinois)

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Contributions to Monthly—Representatives, Affiliated Societies
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Industrial Sales—F. F. CAULEY, Chicago, Ill.
Sales Stimulation—WM. GOULD, Boston, Mass.
Educational Pamphlets (Sub.)—J. P. HANLAN, Newark, N. J.
Merchandise Advertising (Sub.)—J. E. DAVIES, Chicago, Ill.
Nominating—DORSEY R. SMITH, Baltimore, Md.
Program—WM. GOULD, Boston, Mass.

Sales Plans for September

Suggestions from the Sales Stimulation Committee.

THIS fall offers a most unusual opportunity to permanently increase the gas sales of your present customers, with little expense other than the cost of selling the merchandise or the jobbing work incident thereto.

How many gas men will take *full* advantage of such an opportunity? The conditions brought about by the coal and railroad strikes will compel many domestic customers to use gas for cooking and heating to a much greater extent than ever.

People must have heat, and if those who have been depending upon coal cannot get it they will turn to gas and we must be ready to meet such an increased demand for our service.

We want to retain these customers for all year cooking and water heating, and for fireplace and wall bathroom heating. The way to do it is to convince them that gas is the ideal fuel for such purposes and show them by facts that all things considered coal is far more costly for these purposes than gas.

The water heater sales this year are an evidence of what can be accomplished, so let's apply similar methods to increasing the gas cooking, gas water heating, gas heating and gas lighting business this fall and winter.

The gas business is no longer a seasonable business and gas consuming appliances can be sold with the right kind of effort twelve months of the year.

Neglect one branch of the business and it affects others; hence the necessity, this fall, of giving serious consideration to *gas lighting*. Poor gas lighting means poor gas service to a large percentage of gas customers, and this results in loss of revenue to the gas company which they might just as well have. It also means a loss of prestige to the gas industry.

Let's take hold of the problem this fall and make a start toward remedying present gas lighting conditions found in many homes. The right lamp in the right place rightly maintained will do it.

The Sales Stimulation Committee makes the following suggestions for Fall sales. These may be modified to suit local conditions—but "let's go" on some basis. What we want is concerted action by every gas company in the Association.

Replace Coal Kitchens with All-Gas- . Kitchens This Fall

First—Select a list of the most likely prospects and present the facts as to the cost of coal versus gas either through letter or folder, followed by personal call of your sales representative.

Second—Use newspaper space to tell your story. Call on the Association for advertising copy and illustrations if you haven't them now. Write Mr. William Gould, Chairman of Sales Stimulation Committee. He has facts and figures on the cost of coal versus gas for fall and winter cooking.

Water Heating

Keep up the good work so well started this year. Show people what it really costs to use coal for heating water. Visualize these facts through actual window and show room displays.

Use newspaper space liberally; rightly used it is an inexpensive way to get a message to your customers.

Auxiliary Heating by Gas

Today we are in a position to go after this profitable business. Feature the best there is in fireplace and wall heaters, because they are attractive and efficient and they represent a permanent investment and offer a service so satisfactory that it will be used throughout the year. The small portable space heaters are all right in their place but it is at best a second place in room heating by gas. Don't question the price of these handsome fireplace heaters. It costs money to design and perfect them. Let the customers whom you serve decide what price they will pay as after all you as a merchandiser of gas appliances can do no less than offer them the best there is, and what's more it is the duty of gas men to keep up the standard of gas consuming devices. Don't lower your standard of quality to meet price competition of competitors but rather cooperate with them and induce them also to sell quality goods.

Now, then, how are we going to get the maximum of this auxiliary heating business for gas this Fall.

(1) Stock up on a complete line of attractive gas heaters of all types—fireplace types, wall heaters, gas steam radiators, space heaters.

(2) Prepare direct-by-mail folders yourself or get them from manufacturers for distribution to prospects.

(3) Have a good big live prospect file for intensive work and for quick follow up and closing of the most available business.

(4) Make a worth while display in our offices, arranging this display naturally and attractively; a fireplace type in

a fireplace lighted so people will feel its warmth as they pass; wall room types on suitable wall background; gas steam radiator types with steam up; space heaters in a group.

(5) Use newspaper space freely but wisely. Get copy and illustrations from Association or the manufacturers if you have none yourself.

(6) Use attractive signs on your wagons or automobiles and in your windows and offices. Tell the story that gas is the ideal fuel for auxiliary heating purposes in every possible manner.

(7) Make your prices right so that you will do volume business.

(8) Make your terms popular ones so that people will buy better heaters because of your terms.

(9) Sell yourself the proposition and sell it to your organization. If you have not a fireplace heater in your own home put one in.

Gas Lighting Drive for More and Better Gas Lighting

There is just one sure way of bettering the gas lighting of your customers and that is to have men call at their homes who can sell the right lamp in the right place, replace the obsolete fixture with a newer type, replace unsatisfactory lamps with new ones, repair good lamps by selling mantles and glassware. No other method offers quite the opportunity to do this as selling from motor cycles, wagons or automobiles by one or a dozen men. First, because men working from suitable vehicles can have instantly available a wide variety of material and sufficient stock. The former plan of selling one unit for every room is out of date. You wouldn't use a kitchen chair in the living room; neither should a gas lamp that is ideal for use in the kitchen be installed in the living room, which is likely to happen if one unit is campaigned. People don't want just light. They want the proper amount of illumination for the purpose desired and they want that illumination from a source that is attractive. Hence gas lighting should be made attractive as well as useful. How are we to bring this result about?

Buy the right assortment of fixtures, lamps, accessories, glassware, both simple and decorative.

Equip our displays this fall with the newest and best gas lighting fixtures, lamps and attractive glassware.

Set the standard; the dealer won't. Why should he if he can make more selling something else. He is only interested in the immediate profit on a sale. We want the profit on our merchandise and also an inducement for the customer to use more gas.

Prepare some attractive folders and gas bill stickers, or get them of manufacturers and distribute these broadcast so that people who cannot see your displays will know what is newest and best in gas lighting fixtures, lamps, etc. Price these articles so that volume sales will result; so that people will replace present equipment with newer and better styles.

Make our terms of sale low so that the masses can buy more of these gas fixtures, lamps, etc.

With each sale include the first renewal so that customer will not be without lights should mantle break.

Have some plan whereby the customer can get maintenance service of the gas company easily—inexpensively.

This is the gas company's insurance that the material will be used indefinitely after it has been sold. Get acquainted

with good gas lighting yourself so that you can sell your organization and they in turn your customers. Employ men and women and pay them on a basis that will make it worth their while to sell gas lighting merchandise, and supervise their work so that you are assured every customer is called upon.

Give these sales representatives names and addresses of people to be called on and get an intelligent report on each card.

Advise Association headquarters what your sales plans for the Fall and Winter are going to be—the exchange of such information will be helpful to the entire industry. Remember the service of A. G. A. Headquarters is yours for the asking.

Important Announcement of
REDUCED RAILROAD FARES
Atlantic City Convention

In connection with the Fourth Annual Convention of the Association to be held at Atlantic City, October 23 to 27, arrangements have been made with the several Passenger Associations in the United States and Canada to allow all delegates, including dependent members of their families, a REDUCED RATE of a fare-and-a-half for the round trip on the identification certificate plan from all territories in the United States and Canada.

The following directions must be followed to secure the advantage of this reduction in fare:—

The IDENTIFICATION CERTIFICATE must be presented to the ticket agent when purchasing tickets, this being his authority for issuing you a round trip ticket to Atlantic City at the reduced rate of a fare-and-a-half.

Those attending from Pacific Coast points should confer with their home ticket agents relative to reduced fare routes, etc., as the Transcontinental Passenger Association has certain special tourists' rates, etc., about which it will be to the advantage of our delegates to inquire at time they purchase tickets.

Be prepared to identify yourself to the satisfaction of the ticket agent.

To secure this reduced rate, tickets must be purchased from October 19 to 25, inclusive, but must be used in returning to reach original starting point not later than midnight, November 3rd.

Return tickets issued at the reduced fares will not be good on any limited train on which such reduced fare transportation is not honored.

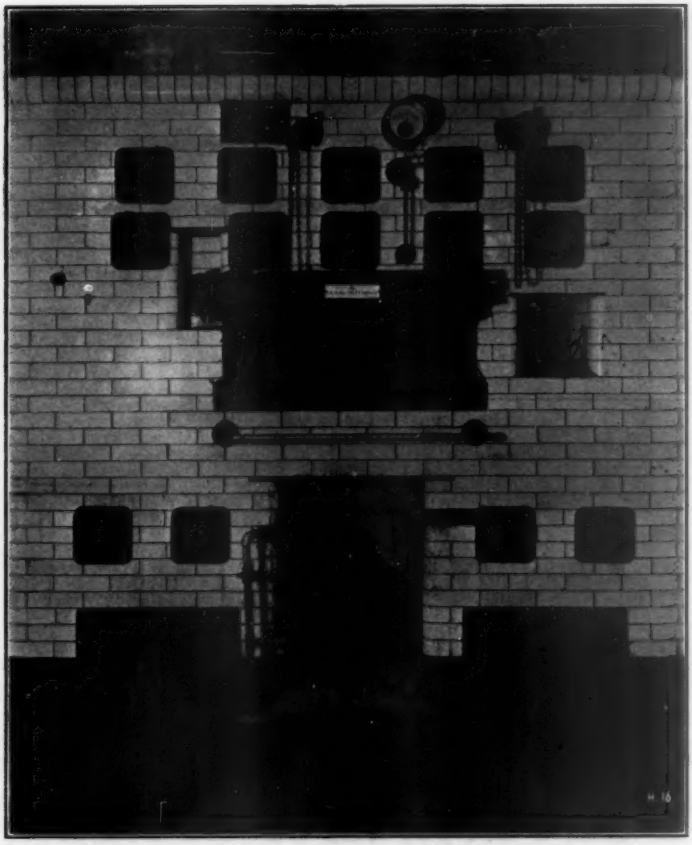
Before leaving Atlantic City all tickets must be stamped by the ticket agent at the regular ticket office in Atlantic City.

Gas Fuel for the Jewish Baker

Oven Direct Fired, with Two Burner Units
Size of Oven 12′ wide, 14′ deep.
Temperature maintained 650 deg. F.

Daily Capacity—1,000 Loaves Rye Bread—1,800 Rolls
Average Gas Consumption—1,000 cu. ft. per hour, or 200,000 cu. ft. per month, per oven.

Detailed information on file at A. G. A. Headquarters



Gas Fuel for the Hotel Bake Shop

Oven Indirect Fired, Using One Burner Unit.
Size of Oven—9 ft. wide, 9 ft. deep Capacity—1,400 pieces per day
Maximum Gas Consumption—500 cu. ft. per hour, or
100,000 cu. ft. per month, per oven.

Detailed information on file at A. G. A. Headquarters.

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Studies of Iron Sulfide with Especial Reference to the Purification of Illuminating Gas from H_2S*

A thesis by Louis Gedel printed in Munich in 1905. Translated by C. H. Stone, Rochester Gas and Electric Corp.; and abstracted and summarized by A. R. Powell, U. S. Bureau of Mines, members of Purification Committee, American Gas Association.

The Purification Committee of the American Gas Association for 1921 suggested that a theoretical study be made of the reactions occurring in gas purification. Since that time a copy of a thesis by Louis Gedel has been received by the Committee for 1922, and as the work described therein bears directly on this problem, it was deemed advisable to present the investigation in such a manner that it would be accessible to any gas man who might be interested. To most gas men the results of this work, although printed in 1905, will be new and probably of some practical value. The complete English translation may be obtained from the Alpha-Lux Company, 192 Front Street, New York City, which has issued the paper in mimeographed form, and will send a copy to anybody who desires one. Following is a brief of Gedel's investigations. (EDITOR'S NOTE.)

*Published by permission of the Director, U. S. Bureau of Mines.

IN 1847, R. Laming, and in 1849, Clark Hills took out patents for the purification of gas by iron oxide. No satisfactory explanation for the fouling reaction was advanced until 1869, when Brescius stated that Fe_2S_3 was the resultant product. This theory was shared by Berzelius, Knapp, D'Harcourt, Schilling, and Graham-Otto. Another theory stated that FeS and free sulfur were the final products, and this was supported by Wagner, Schwarz, Cligg, and others. The investigations of Wright in 1883 tended to show that both of these iron sulfides were formed.

The mechanism of the revivification reaction was at first believed to consist in the conversion of Fe_2S_3 into $FeSO_4$ and free S, but the investigations of Schilling showed that Fe_2O_3 and free S were the products of revivification. Other investigators showed that $FeSO_4$ may be one of the revivification products under certain conditions, but always in much smaller quantity than Fe_2O_3.

The present investigation was designed to clear up many points in dispute concerning gas purification reactions, and was carried out under the three following divisions:

1. Pyrogenic preparation of iron sulfides: This phase had no direct bearing on gas purification, but was designed to obtain more knowledge concerning the sulfides of iron.

2. Preparation of Fe_2S_3 in the wet way: Since this was done in solutions, it has no direct relationship to gas purification, but was valuable in showing the course of the reactions under various conditions of alkalinity, acidity, etc.

3. Action of H_2S gas on iron hydroxide ($Fe(OH)_3$): This part of the work could be applied directly to gas purification practice, as the dry purifying material was used. Another phase of this investigation was the study of actual fouled iron oxide as obtained from the gas works.

1. *Pyrogenic preparation of iron sulfides.*—When iron was heated with an excess of sulfur at 450 to 500 deg. C., FeS_2 was formed, as proved not only by the iron-sulfur ratio, but also by its chemical and physical properties. On further heating to about 700 deg. C., the magnetic sulfide of iron, approximately Fe_7S_8 was formed. When this was carried to a very high temperature, FeS was obtained. No intermediate formation of Fe_2S_3 was noted, and the conclusion is that Fe_2S_3 is not formed by this method.

2. *Preparation of Fe_2S_3 in the wet way.*—This portion of the investigation was carried out by the use of two solutions, namely, a solution of ferric chloride, which, by hydrolysis, is acid; and a solution of ammonium sulfide, which is alkaline, due to hydrolysis. By regulating the quantities of each, the precipitation could be carried out in acid or alkaline medium as desired.

The precipitation under alkaline conditions was carried out by adding the ferric chloride solution to the ammonium sulfide in such quantity that the solution was still alkaline at the end of the operation. Under these conditions a black precipitate was obtained from which no free sulfur could be detected by extraction with CS_2. This seemed to indicate Fe_2S_3, since a mixture of FeS and free sulfur would show some sulfur extraction by this method. Analysis of the precipitate showed the atomic ratio of iron to sulfur to be exactly 2 to 3. This latter observation, of course, did not prove that the material was Fe_2S_3,

since a mixture of FeS and free sulfur obtained from any ferric salt would show the same ratio, but the absence of free sulfur pointed pretty clearly to the formula Fe_2S_3.

Various authorities had differed as to what took place when Fe_2S_3 was treated with an acid such as HCl, and this investigation showed that the following reaction took place under these conditions:

$$Fe_2S_3+4HCl=2FeCl_2+2H_2S+S$$

This was shown to be correct by the fact that the amount of free sulfur in the residue was exactly one-third of that necessary to form Fe_2S_3 from the iron present.

The behavior of Fe_2S_3 towards both moist and dry air was studied. The amount of oxidation which had taken place was measured by the increase in weight and the results showed that oxidation occurs much faster in moist air than in air which had been thoroughly dried. After complete oxidation had taken place, as shown by the change from black to a yellow color, the product was treated with HCl and the residue oxidized with bromine. All of the iron was taken up by the acid solution, as well as a small part of the sulfur in the form of sulfate, while the remainder of the sulfur went into solution only after the oxidation with bromine. From these results it was decided that the oxidation took place as follows:

$$Fe_2S_3+3O\ (air)=Fe_2O_3+3S$$

While Fe_2S_3 was the product obtained when ferric chloride was added to ammonium sulfide in such proportions that the solution was alkaline, entirely different results were obtained when the ferric chloride was present in excess and the solution was therefore acid. Under these conditions the precipitate contained free sulfur which was extracted with carbon bisulfide. When the extracted material was treated with HCl, evolution of H_2S and the formation of a clear solution were the results. This behavior, as well as the iron-sulfur ratio, showed that the material was FeS, and the complete reaction in acid solution is therefore shown as follows:

$$2FeCl_3+3(NH_4)_2S = 6NH_4Cl+2FeS+S$$

When this precipitate, consisting of ferrous sulfide and free sulfur, was heated in a stream of CO_2 at a temperature above 100 deg. C., only a trace of extractable sulfur remained, and further treatment with HCl showed that a considerable conversion of ferrous sulfide into FeS_2 had taken place during the heating. The complete analytical results proved conclusively that the larger part of the free sulfur originally present in the precipitate had combined with the ferrous sulfide during the heating to form FeS_2.

Furthermore, it was shown that with increasing alkalinity in the solution, an increased amount of Fe_2S_3 was formed rather than FeS, as would be expected from the above results. When this Fe_2S_3 was heated in the presence of free sulfur in the same manner as the FeS no conversion to FeS_2 took place, thus showing that the intermediate formation of FeS was necessary in order to obtain FeS_2.

When tartaric acid is added to a solution of a ferric salt, ammonia may be added without causing precipitation of the iron. When ammonium sulfide was introduced into such an alkaline solution of iron, a black precipitate was formed, which, on examination by the

methods described above, proved to be Fe_2S_3. This confirmed the general theory that Fe_2S_3 is the product formed in alkaline solution, whereas FeS and free sulfur are formed in acid solution.

3. *Action of H_2S on Fe $(OH)_3$.*—The work just described cleared up many points concerning the formation and behavior of the iron sulfides. The remainder of the investigation was designed to study just what happens when hydrogen sulfide acts on iron hydroxide, in other words, the actual reactions during gas purification.

The iron hydroxide used was artificially prepared, and was made as pure as possible. The action of H_2S on this was studied under acid, neutral, and alkaline conditions. Further studies were then made of the revivification reactions, as well as the simultaneous action of H_2S and air on the material.

In order to gain information on the action of H_2S on $Fe(OH)_3$ under acid conditions, H_2S with a small amount of HCl gas mixed with it was allowed to flow slowly over the material. At the end of several days it was examined by much the same methods as were used in the study of the precipitates from the solutions previously described. A portion was extracted with CS_2 to determine the free sulfur present; a second portion was oxidized with Br to obtain the total iron and sulfur; while a third portion was treated with HCl. By this third process, the forms of iron sulfide present could be identified and determined, since FeS dissolves completely, Fe_2S_3 dissolves with the precipitation of one-third of its sulfur, and FeS_2 is not affected by the hydrochloric acid.

The results of this experiment showed that no Fe_2S_3 was formed but that the primary fouling reaction consisted in the formation of FeS and free sulfur. The results were therefore similar to those obtained where precipitation of FeS was carried out in acid solution. Furthermore, the heat of the reaction caused the two primary products to unite to form FeS_2, so that the final product contained FeS, FeS_2, a little free S, and some unchanged $Fe(OH)_3$.

The next test was carried out in the same manner as the experiment just described, but the conditions were kept as nearly neutral as possible. It is very probable, however, that the H_2S contained a trace of HCl, since it is very difficult to remove this completely. The material was examined at the end of 1, 3, 5, 8 and 12 days. The method of examination has already been given and the results are summarized in the following table:

	After period of days				
Content	1	3	5	8	12
FeS_2	5.75%	24.21%	25.29%	28.19%	35.50%
FeS	12.76	29.18	44.28	54.45	53.02
Free S	4.54	7.45	4.49	4.30	5.00
$FeSO_4$	2.80	2.61	2.85	2.90	3.33
Fe_2O_3 H_2O	70.29	15.65	6.91	3.50	0.00

This shows that the products obtained under these conditions are practically identical with those obtained in the former experiment. The chief point of interest in both cases is the entire absence of Fe_2S_3 and the presence of FeS_2 due to secondary reaction between the FeS and the free sulfur.

The study of the action of H_2S on ferric hydroxide under alkaline conditions was carried on in the same manner as the two experiments just described,

with the exception that a trace of ammonia was introduced with the H_2S. Examination of the resultant product showed that nearly all of the material was Fe_2S_3, and that the remainder was unchanged iron hydroxide. This agrees with the results obtained in the precipitation of iron sulfide from alkaline solution, where the entire precipitate was found to be Fe_2S_3.

It has already been stated that Fe_2S_3, such as is formed by the action of H_2S on iron hydroxide under alkaline conditions, is very readily oxidized in the air to Fe_2O_3 and free S. On the other hand, the FeS_2 formed under acid conditions is not oxidized and therefore is not subject to revivification for further use.

Another product resulting from the revivification of sulfided iron hydroxide is ferrous sulfate. In order to determine the conditions affecting the formation of this substance, revivification of the material which had been fouled under alkaline conditions was carried on under different moisture conditions and at different temperatures. The analytical results showed that moisture had no influence on the amount of $FeSO_4$ which would be formed, while higher temperatures were conducive to its formation.

The fact has already been brought out that H_2S acting on iron hydroxide under slightly acid conditions causes the formation of FeS_2, and an experiment in which air was mixed with the H_2S so as to give simultaneous fouling and revivification, showed the same results—in other words, the simultaneous admission of air does not eliminate the formation of FeS_2 under acid conditions.

Study of actual fouled gas purifying material.—In order to study material fouled under actual plant conditions, a large sample was removed from the box immediately after being opened, and was placed in an atmosphere of CO_2 to prevent oxidation. This was examined in the usual manner by (1) determining the total iron and sulfur; (2) determining the nature of the iron sulfides present by treatment with HCl, and (3) determining the free sulfur by extraction with CS_2. The result of this examination is given in the following table.

	%
Fe_2S_3	12.93
$Fe_2O_3H_2O$	28.36
Free S	19.86
$FeSO_4$	1.38
Moisture, etc.	37.47
	100.00

Owing to ammonia in the gas, the purifying conditions in this plant were alkaline, so that the results checked those obtained in the laboratory under similar conditions.

Conclusions and Possible Applications of this Study to the Gas Industry

1. The one outstanding feature of this theoretical investigation is the great difference in action of the purifying material between slightly alkaline and slightly acid conditions. This fact has been recognized by most gas plants in recent years, and attempts have been made to keep the oxide bed alkaline, either by keeping a small amount of ammonia in the gas or by adding lime or other alkali to the oxide.

The action of H_2S on Fe_2O_3 under acid conditions results in the formation of ferrous sulfide (FeS) and free S. At a slightly elevated temperature, such as may exist in any oxide box at times, the FeS and S unite to form $Fe\ S_2$. The

formation of this FeS_2 is undesirable because it cannot be revivified and is therefore dead material so far as further use is concerned. Even when air is admitted with the H_2S, the formation of FeS_2 takes place, provided that the conditions are acid.

On the other hand, the action of H_2S on Fe_2O_3 under alkaline conditions results in the formation of ferric sulfide (Fe_2S_3), while FeS and FeS_2 are absent in such cases. This is highly desirable because Fe_2S_3 is revivified very easily by the action of air to form free sulfur and iron oxide, which is then capable of removing more H_2S from the gas. Furthermore, Fe_2S_3 and free sulfur in the presence of each other at slightly elevated temperature do not form FeS_2, as was the case under acid conditions where FeS and free sulfur reacted.

2. As already stated, the Fe_2S_3 formed by the fouling of iron oxide under alkaline conditions is very readily revivified to iron oxide and free sulphur, and the investigation showed that moisture was a big factor in aiding this action. The maintenance of the proper degree of moisture in the purifying boxes is a well-recognized factor of efficient purifying practice at this day.

3. During the revivification of fouled iron oxide, a small part of the iron sulfide always changes to ferrous sulfate, and this is true whether the fouling was carried out under either acid or alkaline conditions, although the percentage in any case is rather small. The investigation showed that moisture had no effect on the formation of this substance, but that the temperature was a factor, higher temperatures causing more ferrous sulfate to be formed. Since the presence of ferrous sulfate is undesirable in the revivified oxide, care must be taken to prevent excessive temperature rise during revivification.

4. This investigation is particularly valuable in that actual analytical data were gathered to prove the nature of the reactions and products connected with the purification of gas. (So much of the theory which has appeared in connection with the purification of gas has been based on mere assumption and as such is almost worthless.)

Moisture Oven Used in the Analysis of Coal

C. A. LUNN and G. H. KNOBLOCH, Consolidated Gas Company
of New York, New York, N. Y.

STANDARD Methods of Analysis of Coal* specify for the determination of moisture the use of an oven complying with the following:

"Moisture Oven:—This must be so constructed as to have a uniform temperature in all parts and a minimum of air space. Provision must be made for renewing the air in the oven at the rate of two to four times per minute, with the air dried by passing it through concentrated H_2SO_4."

An oven complying with these requirements is described and illustrated in Technical Paper No. 8, Bureau of Mines, pages 12-13. Ovens of this form are obtainable through several of the chemical supply houses but such of these as have come to our attention are of such fragile construction as to make extremely doubtful their satisfactory performance over any extended period. Of recent years the Bureau of Mines has made several improvements in this type of oven but we do not find that these have been described in the literature.

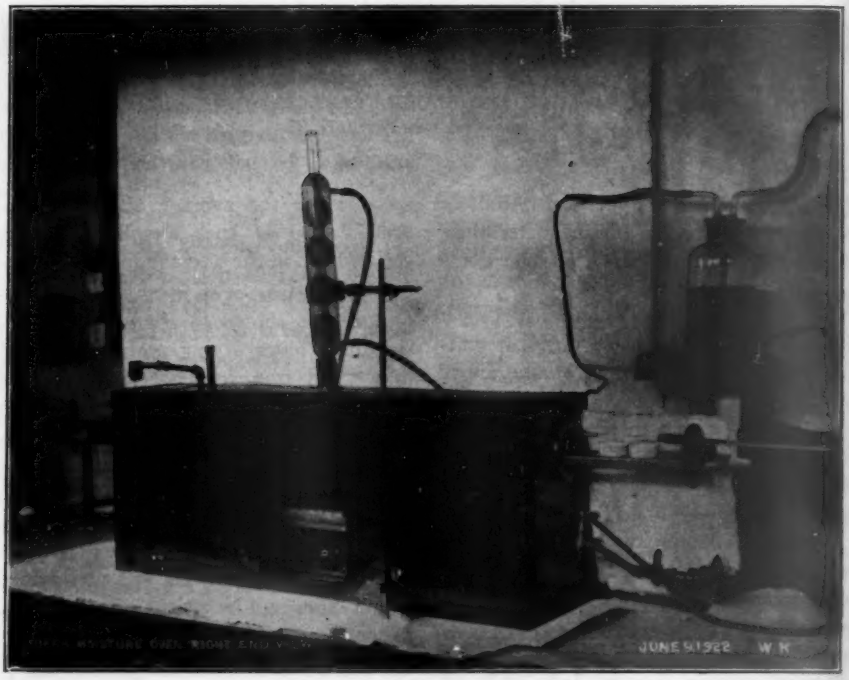
The moisture oven herein described is a modification of a large oven in use at the Pittsburgh Experiment Station of the Bureau of Mines. The Pittsburgh oven is of capacity to accommodate eighty-four samples and the construction is rather complicated. Our effort has been to design an oven of size suitable for the average analytical laboratory and of such simplicity that it can be built in the average machine shop.

The moisture oven in use at our Laboratories is shown in Plate 1. It consists of a brass drying chamber encased in a sheet iron framework and heated by means of a gas burner of the oven type located beneath the drying chamber. Details of construction are shown in Figures 1, 2 and 3.

The drying chamber consists essentially of two concentric pieces of brass pipe, each closed at one end and joined at the other end by means of a brass reducer; thus forming an inner and an outer chamber. The outer chamber serves as a container for the heating medium; a solution of glycerine in water. It contains a copper tube coiled around the inner chamber, which conducts air through the heating medium and into the inner chamber, and is fitted with a gauge glass, drain cock and openings for a condenser and thermometer. The inner-chamber contains a movable brass sample tray on the outer end of which is mounted a brass disc which serves as a door for the inner chamber. The sample tray contains twelve holes of size to support a capsule, 15/16" deep and 1 5/8" diameter. Standard pipe and fittings have been used throughout and brazing has been resorted to only at

*"Standard Methods for Laboratory Sampling and Analysis of Coal," American Society for Testing Materials, Serial Designation D 22-21.

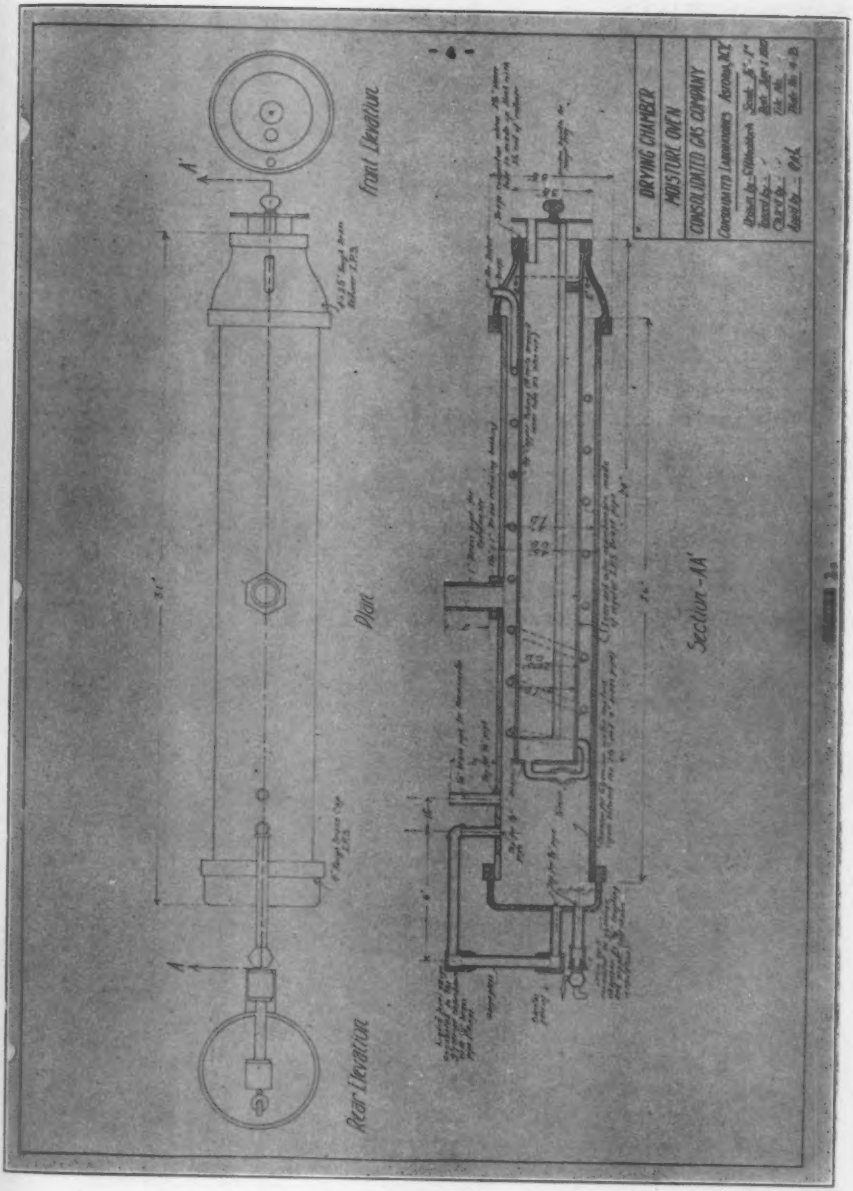
Gas Chemists Handbook, Second Edition, Page 13.

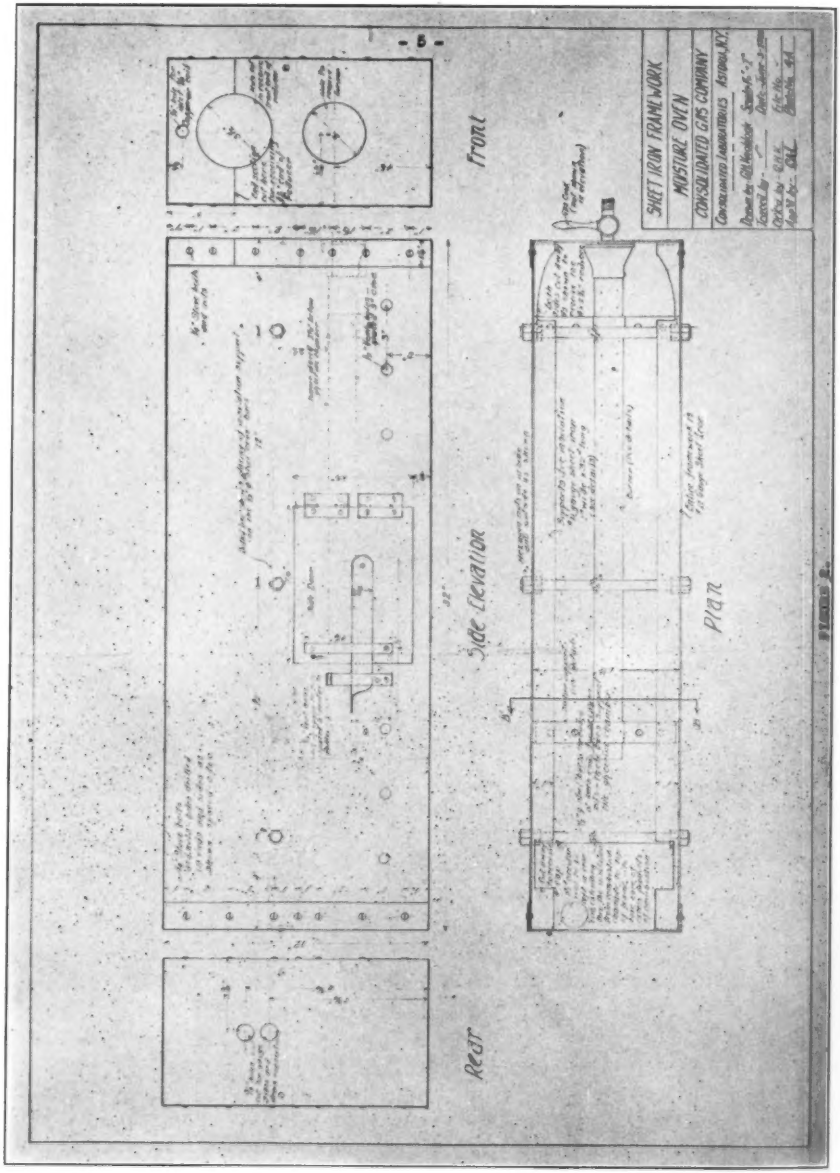


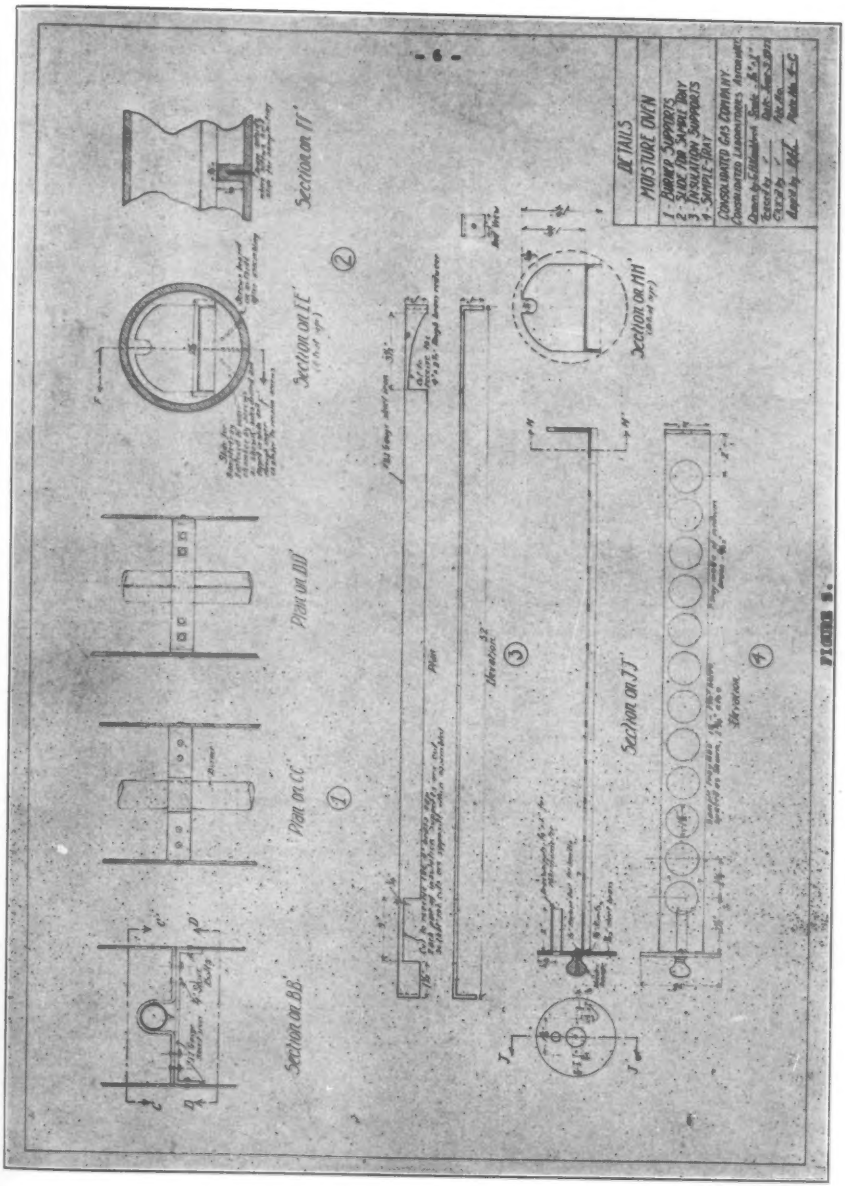
points where deemed necessary to avoid leakage.

The framework is built of No. 11 gauge sheet iron and is fastened together by stove bolts. The drying chamber and burner are supported within this framework by cross bars. A door on one side of the framework gives access to the burner and vent holes on both sides of the framework admit secondary air for combustion and carry off the products of combustion. After the drying chamber has been assembled within the framework, the space between the drying chamber and the framework is filled with a suitable insulating material so that only the bottom of the drying chamber is exposed to the burner flames over about one quarter of its circumference.

The oven is operated as follows: The space between the iner and outer walls of the drying chamber is filled with a solution of glycerine in water (specific gravity 1.19 at 15.5 deg. C.) of such proportions that the boiling solution maintains a temperature of 105 deg. C. in the inner chamber. A return condenser keeps the concentration constant. The burner is lighted and the glycerine bath raised to boiling temperature. A current of air, dried by passing it through gas washing bottles contained concentrated sulphuric acid and preheated by passing through the copper coil contained in the bath, is forced through the inner chamber of the oven and over the samples at such rate as will renew the air in the oven two to four times a minute. Two sulphuric acid air washing bottles arranged in series


DRYING CHAMBER
MOISTURE OVEN
CONSOLIDATED GAS COMPANY
Front Elevation
Plan
Rear Elevation
Section - AA'


SHEET IRON FRAME WORK
MOISTURE OVEN
CONSOLIDATED GAS COMPANY
Front
Side Elevation
Plan
Rear


- 6 -
DETAILS
MOISTURE OVEN
1 - BURNER SUPPORTS
2 - SHOE FOR SWIVEL TRAY
3 - INSULATION SUPPORTS
4 - SWIVEL TRAY
CONSOLIDATED GAS COMPANY
Section on BB'
Plan on CC'
Plan on DD'
Section on EE'
Section on FF'
Section on GG'
Section on HH'
Section on JJ'
Elevation
Plan
PLATE 6.

are used for drying the air circulated through the oven. When the specific gravity of the acid in the first bottle has dropped to about 1.4, the acid is discarded and replaced with concentrated sulphuric acid. This bottle is then placed in No. 2 position and the other bottle advanced to No. 1 position. A ready means of keeping track of the concentration of the acid in the first bottle is by the increase in volume. We have found it convenient to place two valves in the air line just ahead of the air washing bottle; one valve being a needle valve for purpose of adjustment and the other any suitable type of shut-off valve.

The moisture oven shown in Plate 1 has been in continuous operation in our Laboratories for about eight months and has given extremely satisfactory service. A temperature of 105 deg. C. (± 1 deg. C.) can be maintained in the drying chamber over a period of hours without difficulty.

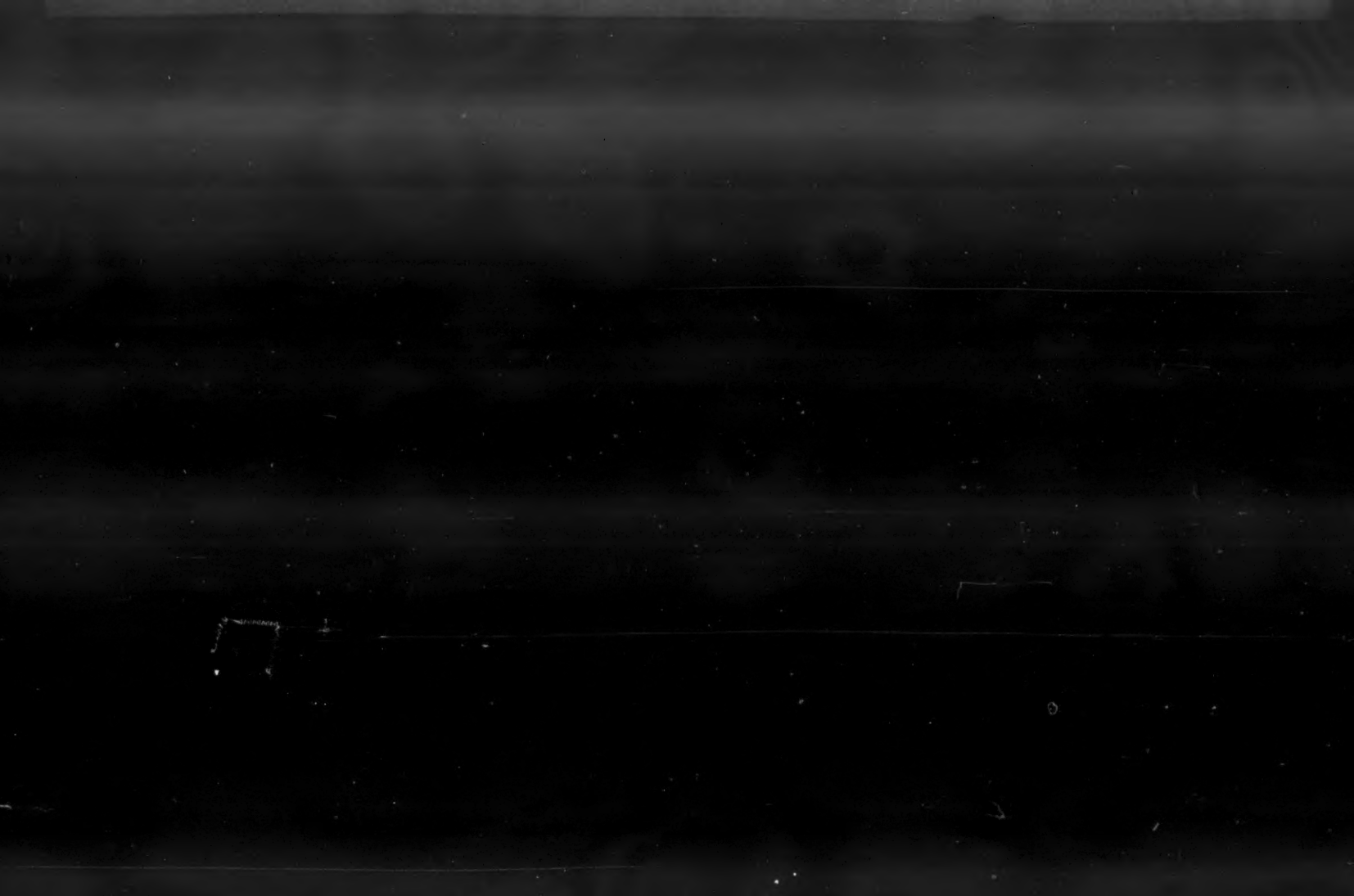
Michigan Gas Association

This year, on September 13, 14, 15 and 16, the Michigan Gas Association will hold its annual meeting in a novel way. They will embark on the steamer "Manitou" at Muskegon on the evening of September 13, and while cruising along the shores of Lake Michigan will hold its business sessions, returning to Muskegon on September 16. Besides the well balanced program of papers this meeting presents a novel and interesting trip.

The Michigan Association extends a hearty invitation to join them and see how pleasant as well as instructive a convention on Lake Michigan can be.

Illuminating Engineering Society Convention

The Sixteenth Annual Convention of the Illuminating Engineering Society will be held at the New Ocean House, Swampscott, Mass., Sept. 25 to 28. An attractive program of papers and entertainment has been arranged and the four days should prove very profitable to those attending.



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WANTED—Position as executive in a local office of a gas or a combination gas and electric company. Have had a practical experience in all branches of commercial utility work. Have been successful in dealing with the public and promoting good will of utility companies. Educated in commercial and accounting methods as compiled by N. C. G. A. and N. E. L. A. Well acquainted in office routine and very exact on details and execution of same. Address A. G. A.
Key No. 114.

WANTED—Man of wide executive experience in gas accounting, statistics and system and a record of success in gas appliance merchandising, is now after illness of several years, prepared to sacrifice in size of salary if necessary to obtain exactly the sort of position he is looking for. Inquiries solicited. Address A. G. A.
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WANTED—Graduate Gas and Electrical Engineer—age 33, married, Technical degrees, B. S., M. S. & E. E., Associate member A. I. E. E., member A. G. A. Nine years practical gas and electric public utility operation in responsible capacity. State Public Service Commission Engineer. Prefer work as Manager or Assistant Manager of gas or combination gas and electric property. Now in New York. Location anywhere. Best of references. Address A. G. A.
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GAS ENGINEER wants position with holding company or large operating company, fifteen years experience working directly under three successful managers with one of the most diversified Public Utility Companies in America. Experience includes design, construction and operation in all branches from coal mines to consumers' burners and rate structures. Address A. G. A.
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GAS RESEARCH ENGINEER—Now employed by a Government technical bureau, would like position as Testing, Research, or Inspecting Engineer with a large gas company or a chain of gas properties. 37 years of age. Author of several Government, State and Technical journal reports on gas research problems. Active member of several A. G. A. technical committees. Has had several years of practical gas operating experience as chemist and superintendent in addition to gas investigative work. Address A. G. A.
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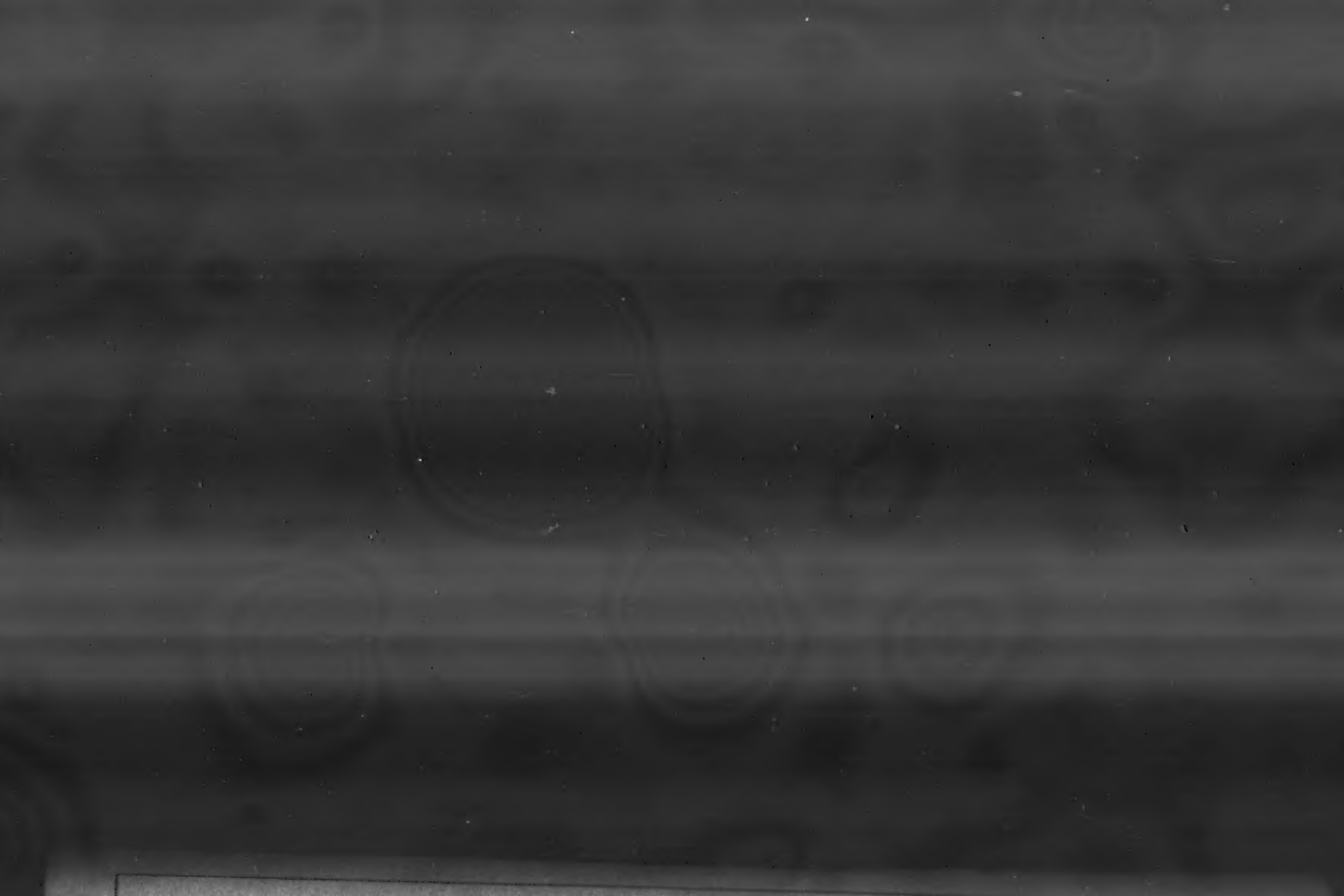
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